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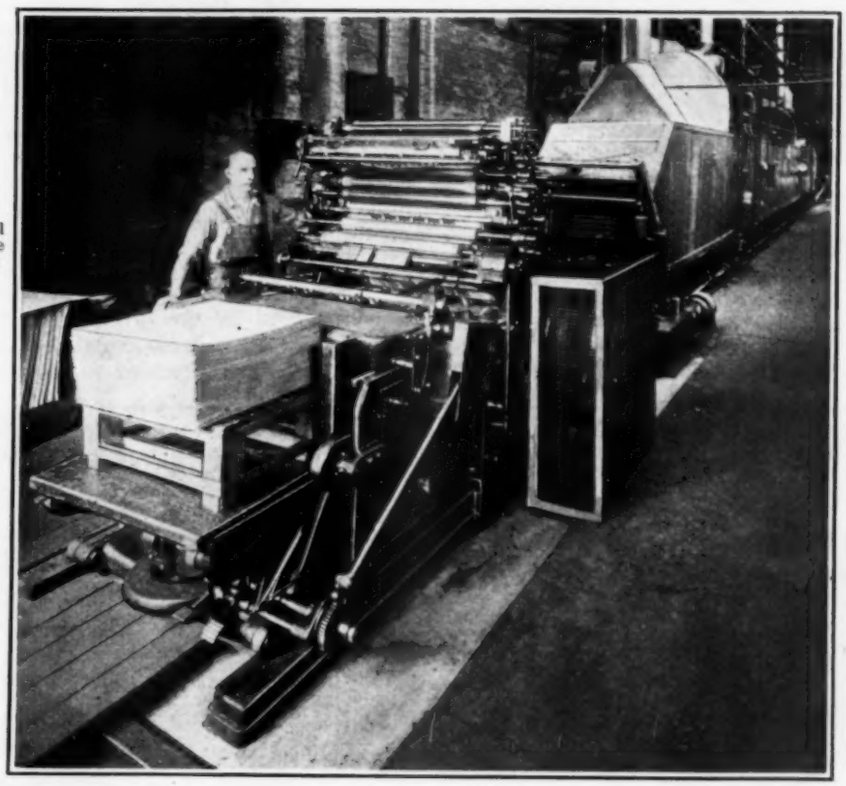


Fig. 1—Press end and line view of the lithographing oven

Sheet-Metal Lithographing by Production Methods

By W. W. Burden

THE growing importance of metal decoration is being recognized by modern industry. Greater variations are constantly appearing in the metal decorator's product and wider applications are being presented. Metal lithography is highly specialized, and at present only one of the large steel manufacturers has entered this phase of the industry, i.e., the Wheeling Steel Corporation, which operates a lithographing department for decorating steel sheets and tin plate. This department, together with 24 hot mills for tin plate production, is located on the Ohio River at Yorkville, about 10 miles north of Wheeling, W. Va. The plant covers an area equivalent to a city block, and is housed in a monitor type structure designed to meet every requirement in the lithographing process.

Production covers a great variety of work, and involves numerous painting and coating operations. Practically no two jobs in this class of work are exactly similar. Because of the wide variation and the character of the operations required, production figures on a tonnage basis alone, would at best tell only part of the story. However, the plant is equipped to handle a maximum production of 72,000 printed sheets and 80,000 coated sheets per day, these figures based on a single decoration. If all the product required just a single operation, the output would be approximately 50,000 base boxes of metal for a month's run of 25 working days. Since the plant was built about six years ago, its capacity has been increased 100 per cent, and further enlargements are now being undertaken.

Any size of tin plate or black plate 24x32 in. and smaller can be handled by the equipment now in use. If the size desired requires special rolling, delivery of the decorated stock is usually made within four weeks. This is possible because of the fact that the rolling mills are directly adjacent to the lithographing plant. If the standard-size plate can be used a much quicker delivery is possible, the time depending on the nature of the lithographing operations involved. Because of the convenient location of the corporation's tin mills, the product is not boxed, but transferred directly from the assorting rooms to the lithographing plant on large steel transfer cars, electrically driven.

Rotary type offset presses are used in this work, each carrying three main cylinders. From top to bottom these are known as the plate cylinder, the blanket cylinder and the impression cylinder, all being of the same diameter but set in eccentric bushings to permit the necessary delicate adjustments. The plate cylinder carries special clamps to facilitate quick changes and adjustments of the printing plates. Back lash of the plate and blanket cylinders is corrected by special take-up gears. To the curved surface of the plate cylinder is attached the zinc printing plate, which carries the design to be printed. This cylinder revolves counter-clockwise. The blanket cylinder, covered with a special rubber blanket $\frac{1}{16}$ in. thick, revolves clockwise, while the impression cylinder, against which the tin plate is pressed, revolves counter-clockwise.

The ink coming from an elevated fountain is carried by a system of vibrating and distributing rollers to five form rollers covered with leather, the rough side exposed. These form rollers distribute the ink on the printing areas of the plate. On the feed side of the press two flannel covered rollers distribute a slightly acidulated distilled water to the non-printing surface of the plate just before it is inked for each impression. Thus we have part of the plate taking ink and part water.

The metal sheets are carefully cleaned to eliminate any dirt or foreign matter that would interfere with their taking a perfect impression. Coming from the cleaning operation the stock is stacked on a board and rolled on to the semi-automatic feeding mechanism of the press. The bundle of sheets is then elevated so that the top sheet is just above the feeding table. The operator pushes it under the drop rollers, which carry it forward to the automatic registering device, delivering to creepers in accurate register. The creepers having closed on a sheet, the side guides automatically withdraw, leaving free progress for the sheets, even though of uneven size. If by any chance a sheet is not presented to the press while in operation, the impression cylinder is automatically moved out of contact with the blanket cylinder, thus preventing the possibility of printing on the cylinder.

The plate cylinder which carries the printing plate, imprints the design on the rubber blanket, which in turn offsets the impression on the tin plate as it passes between the rolls. Approximately 3,000 impressions per hour are made. The design, by the offset method, is changed from positive to negative form on four occasions. It is first engraved on the stone in the positive form, then mounted on what is known as the stick-up sheet in the negative, next transferred to the printing plate in the positive, then imprinted on the rubber blanket in the negative, and finally offset on the tin plate in the positive.

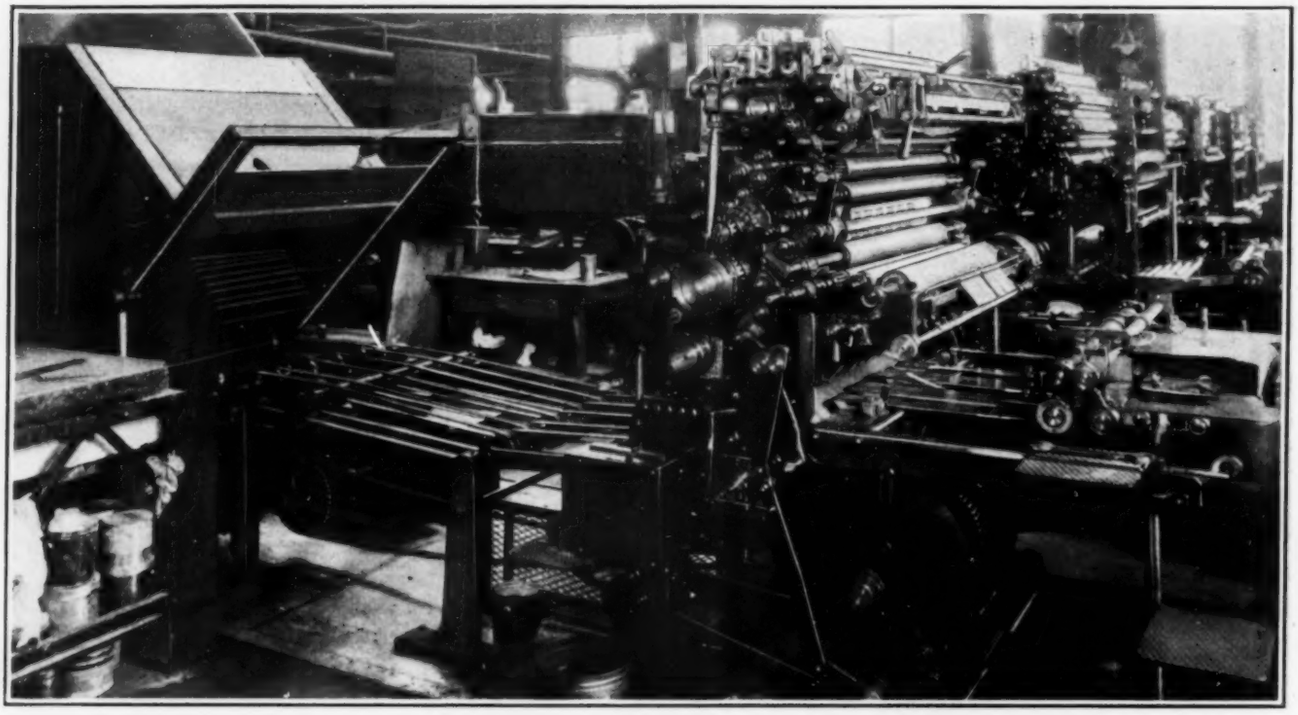


Fig. 2—Lithographing press and entrance end of the baking oven

The application of inks and coatings to the metal surface presents a problem not encountered with an absorptive surface, such as paper. In the case of paper the porous surface absorbs a great deal of the ink and the drying is rapid. The metal surface, however, does not have this characteristic. With the printed metal sheet, if allowed to dry at room temperature, the time element would be prohibitive. Consequently, it is necessary to speed this process by oven treatment. In a properly designed oven the lithographed or coated sheet may be dried in 10 to 30 min., and sometimes less, depending on

the materials used and the ultimate purpose of the product. The sheets coming from the press are dried in an oven where the inks are given a permanent set. These ovens are of the continuous conveyor type, Fig. 1, utilizing the double chain conveyor equipped with finger carriers spaced about 1¼ in. apart. The printed sheets leaving the press are transferred horizontally by short leather conveyor belts to the finger carriers on the main oven conveyor. In Fig. 2 this is shown. They are then picked up automatically by these carriages and carried on through the oven, supported while in the oven either in a vertical or nearly vertical plane. These ovens are about 100 ft. long and are gas fired. Pipe burners are used in this installation in two groups, one for constant heat and one operating under automatic temperature control. Temperature is under accurate control at all times, and is recorded on permanent charts. The products of combustion and fumes from the drying inks are carried from the oven through a specially designed ventilating system. This ventilating system, in combination with the disposition of the heating elements, provides a balanced heat distribution through the oven. In this type of work, accurate temperature and a carefully balanced heat distribution is essential for efficient operation.

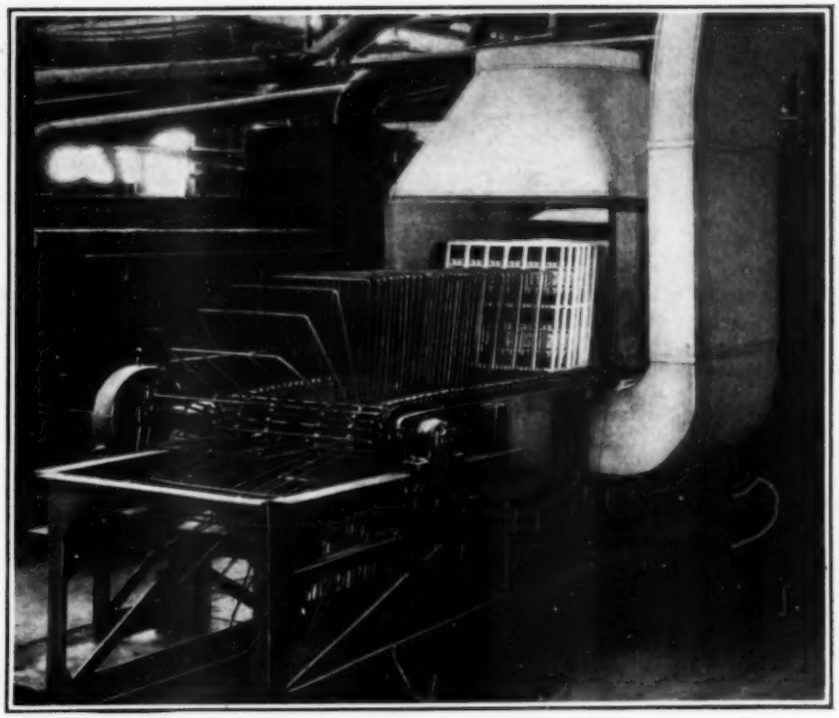


Fig. 3—Oven outlet showing cooler in place at the end

Each separate color on the finished design requires an individual press run, and the number of runs determines the production time. At the Yorkville plant, jobs requiring a number of runs are expedited by employing an entire battery of presses, one press for each color. After the sheets are given their initial printing and baking in the first press run, they are then started through No. 2 press and oven for the second run, then routed through as many more presses and ovens as are required for completing the job, keeping the stock on the move at all times. This rapid movement is facilitated by specially designed coolers through which the printed metal passes before leaving the oven. In Fig. 3 a cooler is shown at the end of the oven. The sheets coming from the oven are cool enough for convenient handling.

After the sheets have left the oven they are removed and piled on skids either in preparation for the next press run or for transfer to the shipping department. Handling the sheets on skids is facilitated by electrically-driven lift trucks. Depressed tracks made of channel iron are inset in the wood-block floor between the ovens. These terminate at both ends in turntables to permit the distribution of the stock to any particular press or coating machine.

All stock decorated by the corporation is shipped to assembly plants that specialize on lithographed work but have no facilities of their own for doing it. The material is all shipped flat, usually packed 112 sheets to the box, ready for the assembling machines. In packing the product, each box is lined with a special grade of paper, while the top and bottom sheets are covered with a waxed paper to minimize damage.

Much of the success in lithographing metal depends upon the baking process. A knowledge of critical temperatures and baking time is essential in order that the coated surface will be dried from the bottom upward, and will not be brittle. Immediately upon completion of the final baking process, or months afterward, the decorated sheet can be bent without breaking the coating.

Rewarding Worth-While Suggestions

MANY concerns are employing a definite system of rewarding employees for worth-while suggestions. It has been found that the observation faculties of the persons immediately concerned with the work have been stimulated so that a flood of valuable ideas has resulted. Of course, but a small percentage of these are of definite value to the company but other benefits accrue as well. Not only are the employees roused from lack of interest in the welfare of the companies believing in such a policy, but they also endeavored in many ways to improve methods and working conditions, so that the plant morale and the quality of work have been uplifted. Labor turnover has decreased and an increase of skill is apparent. Naturally, these beneficial results only came about through a policy that was fair to both parties.

Some employees possess keen power of observation and constructive thought. To these, many substantial rewards have been disbursed. An example is that of J. F. Carlson, employed in the accounting department of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., who has recently passed the $1,000 mark in awards received for adopted suggestions. In recent years 85 ideas for improvements and better production details have brought him additional income. It is interesting to note that these represent approximately 25 per cent of the 364 suggestions submitted by the person in question. Some have been obvious improvements in production, while others have been minor changes in forms, systems, etc., aiming at closer coordination of effort.

Which Type of Equipment?

AN AIR of bustling activity pervaded the shops and offices of the Automotive Parts Company, and William Holland, as he sat waiting for the general manager to finish a heated discussion with the sales manager of a big equipment builder, sensed it at once. The contrast with the lethargy that had prevailed in the last plant he had visited was welcome, but after a bit he began to get an impression that part of the bustle was somewhat aimless, as though it were all ready to start something but didn't know quite what.

The discussion in the glass-partitioned office came to an end and the manager followed his callers out to come over to Holland's chair.

"Sorry to keep you waiting, Mr. Holland," he said, "but the argument I've just been engaged in is part of the difficulty we're having, and about which I want to talk to you. Mr. Hare of the City National told me you could help us out of the quandary we're in, and I certainly hope you can."

"Yes, Mr. Walton," replied Holland, "that fellow Hare always did like to make me work, and I'm foolish enough to want to do anything I can to help him. What's it all about? I gather from what I've seen as I sat out there that you're busy."

"Busy is too mild a word, Mr. Holland. We were comfortably busy on our regular line, and then, last week, we got an order from the Horton people for 100,000 transmissions of a new type. We haven't the equipment to take care of it and they want immediate and regular service from their parts suppliers, you know."

"I've heard they were a little fussy, some times."

"Well, I've talked to sales engineers and chief engineers and sales managers and presidents of equipment companies until I'm blue in the face, and I swear I don't know whether to put in standard equipment with special attachments and fixtures or go to special machines. I'm almost flabbergasted at the rate of production some of these equipment fellows promise. Even though their charges are high the cost per piece would be remarkably low."

"Yes," observed Holland. "And I believe that you can put a lot of faith in the truth of what they tell you. The equipment builder is certainly doing a great job these days. How many transmissions did you say you were going to build for Horton?"

"The first order is for 100,000."

"That's nice. And then what?"

"Well, we haven't got beyond that just yet. Why?"

"Seems to me that's the nub of the whole business. If you're not pretty sure of a big repeat order I don't see how you're going to get the value out of those special machines no matter how productive they are."

"That's what's worrying me, Mr. Holland. You know Horton has a pleasant habit of suddenly cutting off a parts supplier when he's ready to make the part in his own plant."

"I've heard so, Mr. Walton. The more I think of your problem, the more it seems like one I ran up against during the war. Two plants got orders for big lots of 6-inch shell. The first one remembered that the war couldn't last forever and used all the brains in the outfit to devise ways of using standard equipment. The other one, which had plenty of money but not so much brains, put in one of the finest installations of special shell machinery I ever hope to see."

"I suppose the second outfit turned out a lot more shells than the first one?"

"That's what you'd expect, but the war ended before they really got started; you see they weren't so strong on know-how, and in the meantime the first gang had been shipping more than their quota since the second month. They're still going strong with their standard machines re-tooled and the other crowd have been out of business so long everybody's forgotten them."

Holland picked up a paper weight and hummed a little tune to it, while Walton looked hard at the

hat tree in the corner. Neither spoke for several minutes.

"I get the point," said Walton, finally. "I hate to give up the special machine idea but I don't trust Horton. He's so businesslike he sees nothing but dollars and cents. We'll use our brains on the order we have."

"I thought you would," observed Holland quietly as he reached for his hat.

Executives are invited to discuss the problem involved in the foregoing case. Accepted contributions will be paid for.

Discussion

Making Power or Buying It

My job as engineer of a big industrial plant doesn't lead me to read the *American Machinist* regularly, but our production manager has called my attention to the Executive Forum in the issue for April 26, and I'd like to say a word about it.

Mr. Holland tells John Blackington that he's a machinery builder, not a power generator. True in a sense, but superficial. What Blackington really is is a money maker. In this enterprise he uses lots of things — power and heat among them—and makes a lot more. Small parts, like screws, he probably buys on the market or has them made by some screw-machine jobbing shop, but if he needs enough of some one part to keep a screw machine busy all the time, he'd save money by buying a screw machine and making it in his own plant.

The manufacturer is not primarily in the power or heat generating business, but he is likely to be a heavy user of both. The thing for him to do is to study his power and heat demands. He can't make steam power without by-product heat, and if he uses much heat it is easy to generate cheap by-product power. He probably has to make his own heat because he can't buy it. If he uses enough so that all of his power can be skimmed off the top, he can get that power for a song.

Just the other day *Power* had an editorial that hit the nail on the head. It seems that in the new East River Station of the New York Edison Company, many of the important auxiliaries are driven by steam turbines exhausting to feed water heaters that take all of the auxiliary exhaust steam. One of their principal engineers says that "in the investigation leading to this choice, it was found that the economy was sensibly the same for steam and electric drive, with a balance in favor of steam with respect to reliability and first cost."

And the editor goes on to say, "If steam power can successfully compete with electric power within the central station, where electric power is cheap, why should an industrial plant ever buy power if it is so situated that *all* the steam exhausted by power generating units could be used for necessary heating?"

If the manufacturer will figure his costs covering both heat and power, he will find in many cases that he can make them both cheaper than he can make one and buy the other. Mr. Holland knows this, for he says at the bottom of the first column "unless they have to use a lot of steam." That's it exactly.

Now about this sinking of capital in the power plant. Why not, if it pays? Of course, if Blackington's credit is restricted, and he has to scratch gravel to get what he needs for his factory, that's one thing, but if he can raise money without breaking his fingernails, his own power plant may be a good paying place to put it.

It appears that Mr. Blackington objects to having his valuable time occupied with the details that center in his power supply. Well, if his father took the plant as his hobby, we may pity the engineer, but we can't blame the old man. It's an interesting hobby. But if the new boss doesn't want to fuss around the power plant and thinks he has to, he's fooling himself, or else there is something radically wrong with him or his gang or his plant. The trouble is that many a manufacturer expects power machinery of the vintage of his grandfather to team up with a production plant that's the last word in modern equipment and layout.

If the boss is in doubt as to whether he should run his plant or throw it out, let him retain a competent and unbiased consulting engineer to work the thing out. If the figures show a profit for the plant, and if the boss doesn't want to fuss with it himself, let him hire a good engineer, turn him loose, and forget it.

—H. B. Carey.

What Is Overhead?

An accurate cost cannot be obtained by the method of blanketing on the overhead charge by using a set percentage, unless only one class of work is manufactured in the shop. If the shop manufactures a varied product, the true overhead percentage on the different items will not be the same.

Take as an example a department in which one man is filing castings and another is operating a twenty-thousand-dollar machine. The machine operator will carry all the overhead that the filer will carry and in addition to this there will be such items as the depreciation on the machine

investment, cost of power necessary to run the machine, and the toolroom and millwright charges. Obviously the same percentage is not correct in both cases.

A few of the larger companies, in order to get a more correct overhead rating, are using a machine rate overhead method. A survey of the shop is made and each machine and station is rated at so much per hour. The man running the large machine might have an overhead rating of five dollars per hour, while the man filing castings might have an overhead rating of possible fifty cents an hour. This method gives a much more accurate cost than the percentage method.

The reason that more concerns do not use the machine rate overhead method is because of the detail work necessary to operate this system. Each item of time has to have the overhead added separately, which means more clerical help. With this method the computation of the overhead becomes nearly as much of a task as figuring the labor cost. Whereas, with the percentage system, the overhead can be added on to the finished labor cost in a lump sum. There is practically no work in this method.

In order to get away from all the detail work necessary in the machine rate method, and still obtain a reasonable amount of accuracy, I thing a feasible method would be to use a percentage method and use a different percentage for each type of finished product. This percentage would be found by an analysis.

An electrical manufacturer that makes both motors and switches could have one percentage to apply on switches and a different overhead percentage on motors. A shop that makes steam turbines, surface condensers and pumps could have a different overhead rating on each of the three classes of product.

I do not know of any company using this method, but it seems to me that the plan is feasible.

—W. C. Boston.

The word overhead always gets a "rise" out of me because I have been fighting it for many years, and the first contribution that I sent to the *American Machinist*, about 25 years ago, expressed my ideas about overhead. During the years there have been many strange experiences with overhead, but until Mr. Holland's story came to my attention I had supposed that I was the only one who had been plagued by a Chairman of the Board who could see only the ratio to direct labor, and made trouble if this rose. Several years ago while assisting in changing a large plant from operating 60 hours per week to running only 48, and at the same time trying to reduce costs, I had to combat a chairman who could see nothing but the overhead expressed as a percentage of direct labor. The controllable overhead charges were lowered, but as the uncontrollable portion due to interest on bonds, depreciation, salaries of executives, etc., was very heavy, and direct labor charges had been greatly reduced, the overhead expressed as a percentage of direct labor rose considerably. Each month the chairman spent two or three days at the plant and used nearly all of the time making a row about the overhead expense. Finally he admitted that earnings were increasing, and stopped saying anything about the overhead, but he always believed that something was wrong, even though he could not name it.

The president of another plant complained that he had never had any overhead expense until a cost system was installed, and that afterwards it got bigger each month. Overhead expressed as a percentage of direct labor seldom gives a true picture of the situation, and an executive who looks only at that factor can have some terrible things put over on him. In fact almost any other method seems better, and where operations are performed chiefly by machines, machine hour rates are much to be preferred. Hourly overhead rates are very effective in hand-work departments.

—C. J. Morrison.

About Wage Incentives

Some of the factors that must be right before any incentive system can operate successfully are as follows:

There must be an adequate and efficient inspection department, not because piece-work causes more spoilage, but because any piece-rate system places added detail work upon the inspection force. As no bonus can be paid for defective work, all work must go to the inspector after every single operation, and be checked and counted immediately. It often happens that the thorough checking made necessary by the installation of piece-work, and the penalties imposed for defective work, result in decreased spoilage.

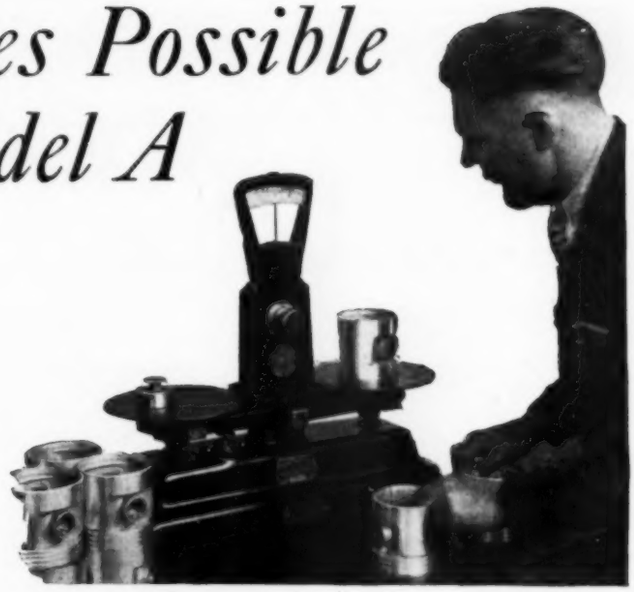
The supply of parts and raw material must be so well organized, that uninterrupted runs will be possible on every piece-work job. If shortage of material, or of parts from a previous operation, forces the piece-workers to change from job to job then the operators, seeing their earnings kept down by the inefficiency of the management, will be more dissatisfied than they would be on a straight hourly rate.

The greatest cause of dissatisfaction with piece-rates is due, as Mr. Holland points out, to some operator increasing his earnings out of proportion to those of his fellow workmen, by some improvement in method. The best preventive of this trouble is a careful study of each job before setting a rate.

Piece-work and day-work will not mix. An operator on piece-work should not be allowed to work on hourly-rate jobs, or he will be tempted to juggle with his time-cards. Paying some men on a piece-rate basis, and others doing similar work in the same department on an hourly basis is also bound to create dissatisfaction.

—C. S. Hazard.

Equipment Makes Possible the Ford Model A



Operations on the Aluminum Piston and Extruded Piston Pin

By Fay Leone Faurote, M. E.

FORD Model A pistons are made of an aluminum alloy. The composition is given in a note in Fig. 1. They are $3\frac{29}{32}$ in. long and weigh 1 lb., $1\frac{7}{8}$ oz. each, within 1 dram. They are equipped with three rings. Twenty operations are necessary to complete them.

Beginning with the boring of the skirt and the facing of the open end on a Reed-Prentice lathe, which handles 240 an hr., the piston is inspected, and the pin hole rough reamed on a twenty - spindle single-index, Ford rotary drilling machine at the rate of 300 an hr. The fourth operation includes rough-turning the outside diameter, roughing out the ring grooves and cutting the horizontal expansion slots. This is done on a four-spindle machine at the rate of 100 an hour. A Reed-Prentice lathe is used for finish turning, the same operation including the chamfering of the horizontal expansion slot and the finishing of the ring grooves. The lugs are then faced for balance on a 20-in. Reed - Prentice drill, while the seventh and eighth operations respectively call for rough-grinding the outside diameter and relief and finish grinding the same surfaces. The work is done on a Ford centerless grinder at the rate of 120 an hr. The wrist pin hole is then semi-finish reamed on a Ford double-end centering machine. The faces of the bosses are milled on the inside with a No. 3 Garvin hand mill (150 an hour). This is followed by an inspection. The oil holes are then drilled on a Leland Gifford single-spindle drill after which the oil holes are burred on a vertical, motor-driven drill of the same make. Both of these operations proceed at the rate of 300 per hr. The pin holes are finish reamed and burnished on a Ford reaming machine at the rate of 120 an hr. After an inspection a $\frac{1}{16}$-in. slot is cut in the skirt on a No. 2 Pratt & Whitney hand milling machine and the piston is stamped "Ford." Then the ring grooves are burred on a Seneca Falls lathe and the pistons are finally washed in a Niagara washer at the rate

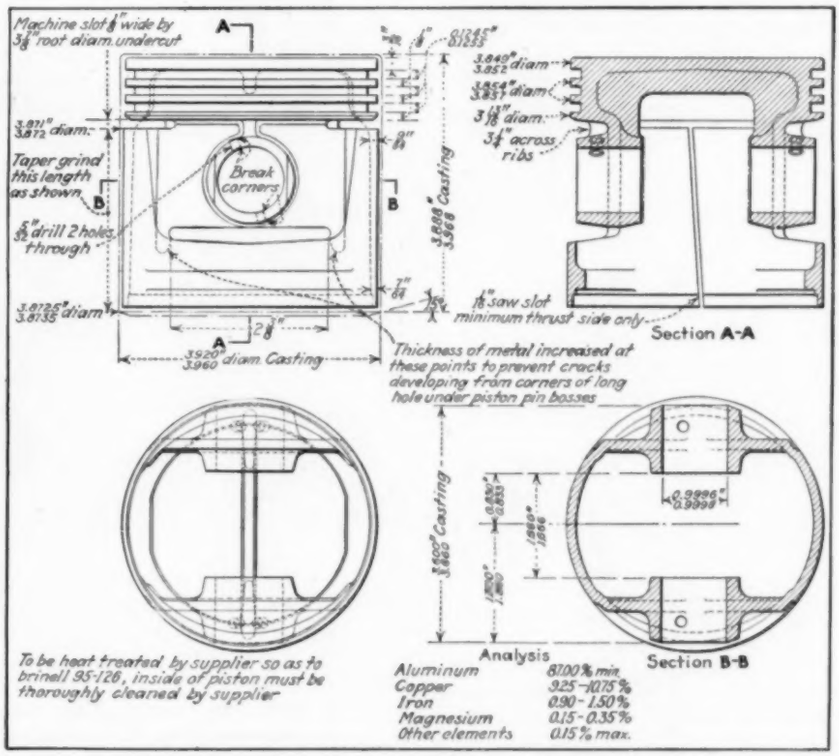

Machine slot 1/8" wide by 3 7/16" root diam. undercut
3.871" 3.872" diam.
Taper grind this length as shown
Break corners
5/32" drill 2 holes through
3.8725" 3.8735" diam.
2 3/8"
3.920" 3.960" diam. Casting
3.888" 3.968" Casting
3.849" 3.852" diam
3.854" 3.857" diam
3 5/8" diam.
3 1/4" across ribs
1/16" saw slot minimum thrust side only
Section A-A
Thickness of metal increased at these points to prevent cracks developing from corners of long hole under piston pin bosses
To be heat treated by supplier so as to brinell 95-126, inside of piston must be thoroughly cleaned by supplier
Analysis
Aluminum 87.00% min.
Copper 9.25-10.75%
Iron 0.90-1.50%
Magnesium 0.15-0.35%
Other elements 0.15% max.
Section B-B

Fig. 1—Details of the aluminum piston used in the new Ford engine. The casting has been designed to give extra strength where stress is greatest, and also to allow for expansion. Note the longitudinal and transverse machined slots. Three rings are provided for

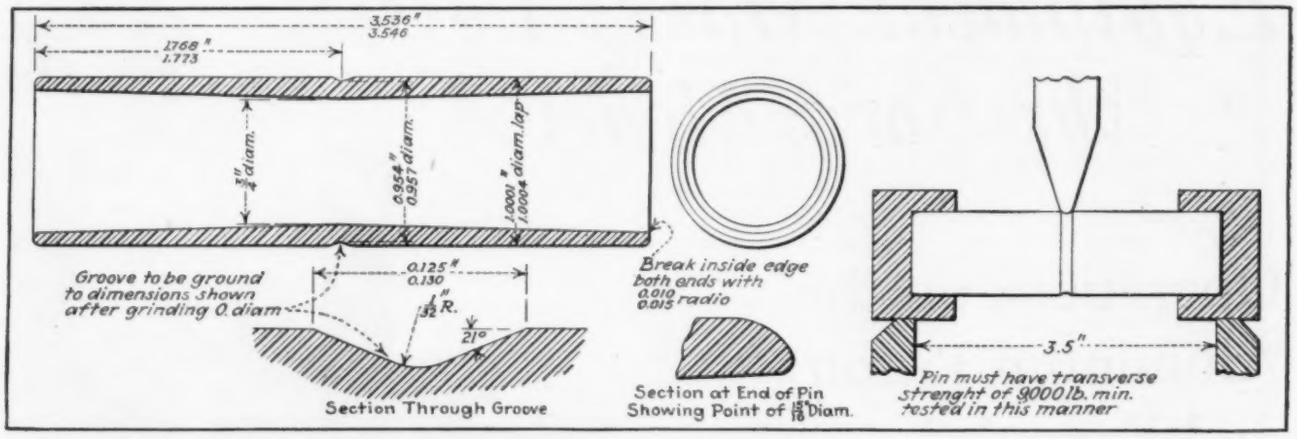


Fig. 3—Details of the piston pin which is made by the extrusion process. Note the close limits to which the lapped outside diameter is held, and the sketch of the device used to test the pin for transverse strength

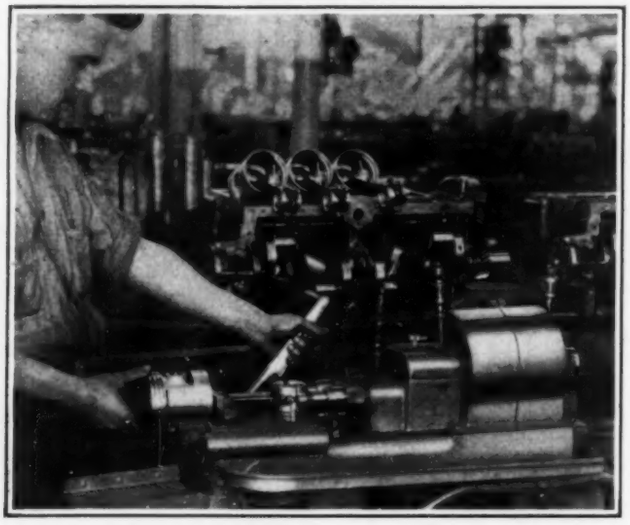


Fig. 2 — A special machine removes the cap nuts prior to assembly of the rod and piston unit. The view is introduced here to show the design of piston and rod. The cap studs are forged integrally with the rod

of 740 an hr. A final inspection makes the pistons ready for motor assembly. A good idea of the shape of the piston and of the connecting rod big end, on which the cap studs are forged integrally, may be had from Fig. 2. The illustration shows the removal of the cap nuts by a special machine, incident to the assembling process.

The manufacture of the Ford Model A pin is interesting because of the extruding method employed in its fabrication. In form, Fig. 3, it is a cylinder 3½ in. long and 1 in. in diameter made of cold rolled "Type N" steel. The pin must have a transverse strength of 9,000 lb. when tested in the manner shown at the right in the illustration.

The heat treatment directions at this writing are: Carbonize at 1,700-1,750 deg. F.; 0.025-0.035 deep from finished size; normalize at 1,650 deg. F.; cool slowly; clean if necessary; taper ream; reheat at 1,600 deg. F.; quench in caustic soda solution; hardness C-58 minimum.

The steel is first cut to length on a P-6 Ferracute press, handling 2,000 parts an hr., centered, and flared out at one end, and then put for heat treatment into a Holcroft Globar electric furnace of the pusher type, which has a capacity of 650 slugs per hour.

The extruding operation, which follows and which is performed at the rate of 210 per hr., takes place on a PF-5 Ferracute press, as does also the piercing and broaching operations which succeed.

The outside diameter is turned to 1.030 in. on a Reed-Prentice lathe, after which the work is carbonized. Both ends are then milled on a Gould & Eberhardt rotary mill at the rate of 200 per hour. The parts are then step-drilled, taper-reamed and chamfered inside and outside, both ends, on a No. 4 Bardons & Oliver screw machine. The pin is next inspected and weighed, then hardened; a Swindell electric furnace being used in this connection. The outside diameter is then ground between centers on a 16x32 Landis grinder.

The fourteenth operation is to rough grind the outside diameter (seven passes, 0.0025 in. to pass) on a special Ford-designed centerless grinder. The hardness is checked with a Rockwell direct-reading hardness tester; the ring groove is then ground on a Fraser automatic grinder and this operation is followed by finish grinding the outside diameter (three passes, 0.001 in. to a pass) on a Ford standard centerless grinder. After a careful inspection the pins are lapped on a Reed-Prentice Mirra cylindrical lapping machine, washed in a specially designed Ford washing machine, given a final inspection and then are ready for assembly in the piston.

A Three-Purpose Tank

It is reliably reported that the gasoline tank on the new Ford has given more trouble to the production men than any other part. The tank is not only a fuel reservoir but the cowl of the body and the instrument board as well. Consequently the factor of appearance must be considered as well as that of mere utility. Its manufacture is described in the next article in this series.

Small Transmission Cases in the Making

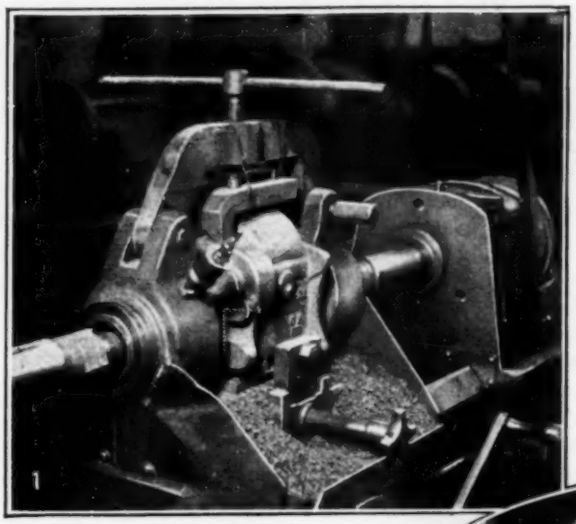


Fig. 1—Preliminary boring of main holes in transmission case. The case is supported on pins at the bottom and is located by jaws on the side. The clamping bar is suspended in the swinging overarm, and the clamping screw forces the floating clamp against the case and holds it firmly

Fig. 2 — Drilling four sides of the case at one setting. This view looks down on the double fixture used in holding four cases at each setting, and in four different positions. It shows how the bushing plate is guided while the holes are being drilled, and also how the cases are held in the fixture

Fig. 3 — Shifting the revolving fixture from one position to the other. This view also shows the four positions in which the transmission cases are held. On each side of the fixture is a pair of guide pins to insure proper location of the bushing plate. The indexing pin is below the table.

Photographs by courtesy of the Warner Gear Works

Fig. 4—Finish reaming main holes. By having the reamer driven through a floating coupling, and exercising a little care in the operation, this method not only gives equally good results as with hand reaming, but saves a large amount of hard physical labor

Respiratory Diseases as a Cause of Disability Among Industrial Workers

AN INVESTIGATION made by the United States Public Service has revealed that in a certain company more than one-half of the absences due to disease were directly traceable to diseases of the respiratory tract. The more common illnesses reported were the ordinary cold, sore throat, tonsillitis, bronchitis, influenza, or grippe, and pneumonia. The record studied was especially valuable since it included all absences of one day or longer for a period of ten years.

The records of employee benefit associations scattered over the northern and eastern part of the United States tell much the same story. From the recorded experience of 35 different sick-benefit associations having a combined membership of nearly 100,000 persons, it was found that respiratory diseases caused 47 per cent of all the cases of illness for which sick-benefits were paid from 1921 to 1926, inclusive. This source of information covers only the more serious sicknesses, because these associations made payments to their members only when illness caused inability to work for eight days or longer.

Thus, whether we consider all absences from work on account of sickness, or only those illnesses which lasted longer than one week, we find that approximately one-half of the cases were some form of respiratory sickness. Apparently, man's breathing apparatus is especially liable to microbic attack. With this evidence that the organs of respiration are particularly vulnerable, it is apparent that we ought to take special precautions against respiratory infection.

The sickness records of the electric light and power company showed, also, that the average loss of time on account of sickness was approximately six days a year per man on the payroll. Approximately three of the six days lost from work per annum were lost on account of respiratory diseases.

Common Cold the Worst Offender

By far the worst offender in the family of respiratory diseases, from the standpoint of time lost, is the common cold which, according to the record of the company mentioned, caused 70 per cent of the absences resulting from diseases of the respiratory system. Colds caused the disability of 4 out of 10 men annually, and of 7 out of 10 women each year. It is no wonder we call it the common cold!

The next most important respiratory disease from the standpoint of time lost by industrial employees is influenza or grippe. In the five years ending with 1924, grippe disabled members of sick-benefit associations at a rate which was more than six times that of all the other epidemic and infectious diseases put together. As a public-health problem even when the disease is not epidemic, influenza is of out-standing importance among the adult population of the country.

Within the family of respiratory diseases, the third largest loss of time is due to the group which may be designated as diseases of the pharynx and tonsils. Tonsillitis, sore throat, and quinsy are the more common diseases in this group. In the experience of six-benefit associations, diseases of the pharynx and tonsils ranked next to grippe in frequency.

The incidence of respiratory diseases varies with the seasons. They occur least often in midsummer. During the late summer and early autumn the number of cases tends to increase. In December or January the increase is usually more rapid, and continues until the seasonal peak of the sickness wave is reached, sometime in the month of February. The smallest number of cases of disabling sickness, non-respiratory as well as respiratory, is found, usually, in the month of July. In most years there is more disabling illness in August than in July; for the seasonal wave of sickness which culminates in February usually starts its upward course in the month of August.

The rate of respiratory sickness was found to be very different among the employees of certain industrial establishments as compared with others. Over a three-year period in the establishment showing the highest rate of respiratory illness there were five times as many cases of respiratory disease causing absence from work for more than one week, per 1,000 men on the payroll, as occurred among the employees of the establishment which showed the lowest rate. Wide differences in the death rates as well as in the frequency of disabling sickness from the respiratory diseases are found in different industrial groups, communities, and cities. A careful study of the causes of these differences would yield information which doubtless could be used to advantage in the work of preventing and controlling the diseases in this group.

Pneumonia Being Studied

The United States Public Health Service is undertaking several studies in this field. One such study, recently begun, is of a specific respiratory disease, lobar pneumonia. Its frequency and the conditions under which is occurs are being observed among several different groups of workers engaged in the production of iron and steel. Records will be kept of the cases occurring over a period of several years, and of the age, race, working conditions, home and community environment, etc., of each man included in the study; and from an analysis of the recorded facts it is believed that reliable measurements will be obtained of the influence of such factors as abrupt changes in temperature, smoke and other causes of atmospheric pollution, and overcrowding, in the occurrence of pneumonia and in its severity. It is hoped, also, that other facts will be revealed from the study which will contribute to a greater knowledge and better understanding of the disease, so that pneumonia may be more successfully controlled and prevented in the future than it has been in the past. The Public Health Service is also conducting studies along similar lines, of other respiratory diseases, such as the common cold, bronchitis, and pulmonary tuberculosis, among persons engaged in dusty trades. We need careful studies of the effect of exposure to large quantities of the difference dusts encountered in industry, and more information as to the effect of other conditions which may predispose to respiratory sickness, as a basis for real control and prevention of these diseases.

Out of a total of 29,638,535 motor vehicles in the world all but 6,384,653 are in the United States.

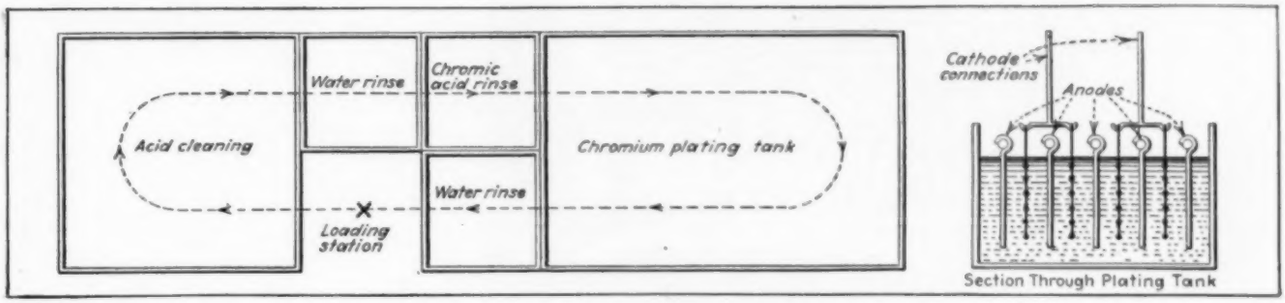


Fig. 1—Layout showing the arrangement of the various baths required for chromium-plating brake cams

Chromium Plating Applied Automatically

By Frank W. Curtis
Western Editor, American Machinist

CHROMIUM plating on a production basis, by means of a conveyor-type unit, is being carried out to plate brake cams by the Chevrolet Gear and Axle Company, Detroit, Mich., a division of the General Motors Corporation. Aside from loading the racks on the conveyor arms and removing them after the cycle has been completed, the operation is actuated automatically, including the transferring of the work through various baths. The primary purpose of the chromium plating is for corrosion resistance, although the deposit has been found to give additional wearing qualities to the parts when in service, because of its extreme hardness.

A layout of the installation is illustrated in Fig. 1. The work to be plated is started at the loading station and is then transferred to the acid-cleaning tank where any oil, dirt, or other foreign matter is removed. Muriatic acid is used as the cleaning agent. The next station is a water rinse, after which the work is passed through a chromic-acid bath which acts as a thorough cleanser removing any scum or dirt particles that may be left on the surface after the work has passed through the preceding baths. Next, the work is transferred to the plating solution, consisting chiefly of chromic acid and chromic sulphate. The solution is heated to approxi-

Fig. 2—A general view of the automatic plating installation showing the chromium tank at the right

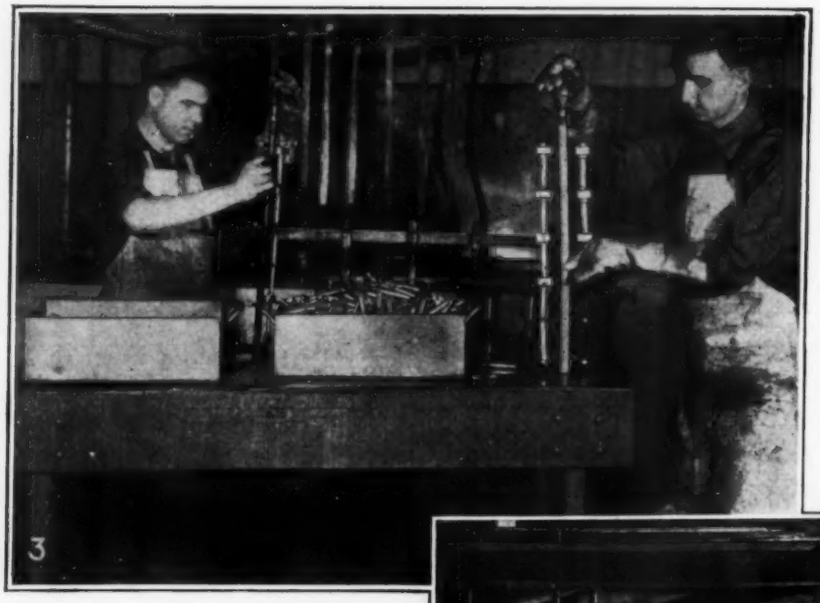


Fig. 3—Operators loading and unloading the racks used in connection with the plating of parts on a production basis. Each rack holds 10 pieces, all being held in place by spring tension between steel balls attached to cross-bars. Celluloid tubing is used to protect the body of the racks from the plating solution

Fig. 4—An operator placing two loaded racks on a conveyor arm. A total of 26 arms are available and of this number 15 are accommodated in the chromium-plating tank. The cycle is completed in 38 min., so that a production of approximately 820 pieces per hr. is attained. The work remains in the plating bath 22½ min. and receives a deposit of 0.0003 in. of chromium on a side

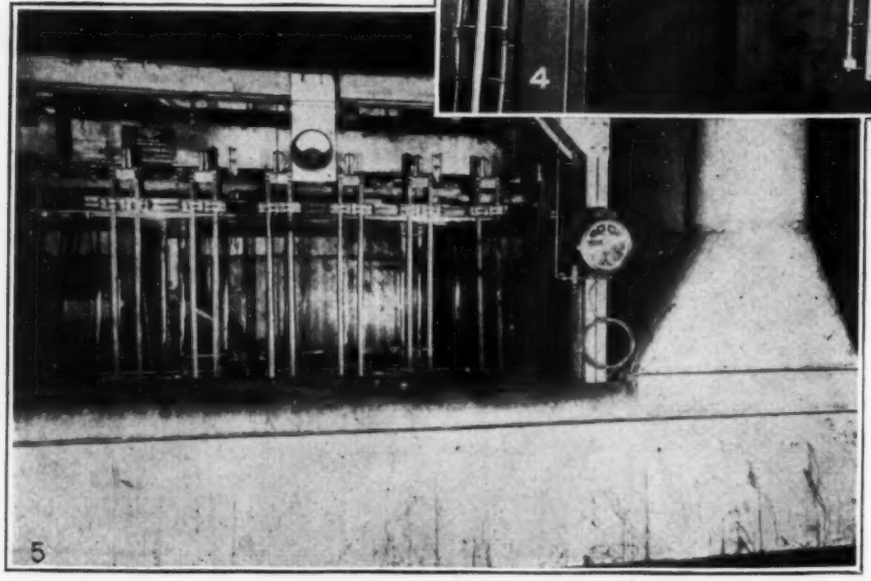


Fig. 5—Fumes and the fine spray are carried off by suction fans that operate in connection with ventilators located on each side of the plating tank. The current density of the solution is checked by an ammeter and its temperature is controlled by an automatic thermostat that regulates the amount of steam admitted to pipes placed within the tank

mately 130 deg. F., and a current of 5.2 volts is passed through it and the work. Following the chromium bath, the work is rinsed in water, completing the plating cycle.

A cycle of the plating process is completed in 38 min., of which time the work remains in the chromium tank 22½ min. The conveyor has 26 arms attached to it, so arranged that 15 of them are suspended over the plating solution simultaneously and the remainder working in connection with the other baths. A general view of the installation is shown in Fig. 2. The plating tank is located at the right.

Brake cams are made of drop-forged nickel steel, machined all over, carbonized and hardened. The shank of the cam, which fits into a bronze bushing at assembly, is ground to from 0.5594 to 0.5604 in. in diameter. Approximately 0.0003 in. of plating is deposited on a side so that the diameter is increased to from 0.560 to 0.561 in. This dimension is checked by a snap gage that determines whether or not the proper thickness of deposit has been made, inasmuch as the parts are given a thorough inspection before being received in the plating department. In addition to this test, the work is given a visual inspection before being sent to the assembly department.

The brake cams are placed in racks as shown in Fig. 3, and the racks in turn are hung on the conveyor arms as illustrated in Fig. 4. Each rack holds 10 pieces. The racks are made of round steel to which six cross-rods are attached. Steel balls are fastened at the ends of the cross-rods and the work is fitted between them so that the balls fit into the center-holes. The spacing of the cross-rods is so arranged as to give a spring fit sufficient to hold the work securely. Celluloid tubing is placed over the sections of the racks (excepting the balls) that enter the solution, in order to prevent the chromium from depositing thereon. Two men handle the entire operation and an average production of 820 pieces per hr. is attained, since two loaded racks are placed on each conveyor arm.

In order to take off the fine spray and fumes produced in the chromium-plating tank, two suction fans are used, being operated in connection with ventilators placed on each side of the tank. Their arrangement is shown in Fig. 5. In the same illustration at the right is shown the automatic steam-temperature control that regulates the heating of the solution, while suspended from the overhead frame may be seen the ammeter used in checking the current density. Heating of the solution is by steam pipes located within the plating tank.

The installation is one of the first automatically-operated chromium-plating units in use. The results attained are highly satisfactory inasmuch as a uniform deposit of even thickness is applied. A similar method is being used in plating wristpins by the same company.

Articles giving detailed information regarding the preparation of work to be chromium plated, the chemicals, the anode and the current densities, also the operation of an automatic plating equipment were published, respectively on page 241, Vol. 68, and page 883, Vol. 67, of the *American Machinist*.

Industrial Personnel Work

THE nature and scope of the various personnel features contributing to the health and general welfare of employees found in various types of industries forms the subject of a report issued by the Bureau of Labor Statistics.

The survey included visits to establishments in different sections of the country, information being secured from 430 companies which were carrying on the various types of personnel work. As a similar study was made in 1916-17 covering practically the same number of companies, many of them identical, the present study affords an opportunity to observe the lines along which such work has developed in the past ten years. The most decided changes were found to have taken place in the kind and quality of the medical care provided, in the extension of the vacation movement and in the phenomenal growth of group insurance.

The increased attention being paid to the maintenance of a healthy working force is shown by the fact that of the 375 plants which were reported in the 1916 study as having some provision for treatment of sick and injured employees, 110 had first-aid equipment only, while in the present study 373 had a dispensary or emergency hospital with one or more treatment rooms and only 34 had the limited first-aid equipment. The improvement is further shown in the number of doctors and nurses employed, as in the earlier study only 171 establishments employed physicians and 181 trained nurses, while in the present survey 311 companies employed full-time or part-time doctors or surgeons and 332 employed trained nurses. The scope of the work done by the medical departments has also been greatly extended so that at the present time there is a general tendency to provide complete and effective health service.

The practice of giving vacations with pay is also one of the developments of the past ten years. In 1916 only 16 companies reported that they gave vacations to the larger part of the shop or unsalaried force, while in 1926 it was found that 133 granted paid vacations to employees. In both studies no companies which required more than two years' service with the firm in order to be eligible for a vacation were included.

The number of companies providing restaurant facilities had likewise increased from less than 50 per cent to about 70 per cent of the total number of firms scheduled. The lunch service is generally regarded by employers as an important factor in maintaining the health and efficiency of the working force.

Recreation activities provided by employers include both indoor and outdoor features. The indoor facilities include the provision of recreation rooms, clubhouses, and gymnasiums, assistance in the organization of clubs and musical and dramatic organizations, and the promotion of social activities among the personnel, while the facilities for outdoor recreation cover the provision of athletic fields and baseball diamonds, tennis courts, golf courses, and swimming pools.

Insurance against sickness and death is provided either in the form of group insurance or through the mutual-benefit associations. Of the plants visited 186 had group-insurance plans in effect, the costs of which are largely paid by the employers, while 214 benefit associations were reported which were maintained and managed by the employees but which in all cases received some material contribution from the employer.

Other features of the personnel work are the opportunity for advancement through further study, courses being provided by many companies which are designed to give ambitious employees the opportunity to progress in the business, or industry; and in various plans for the encouragement of thrift.

According to reports, steel men are considering the effect of competition from beryllium as a metal for use in aircraft construction. It is considerably stronger than mild steel, about half as heavy as aluminum, does not corrode in air and has a modulus of elasticity nearly one-third greater than steel. There seems to be a distinct probability of its becoming a commercial raw material.

NOTES from a Railroad Shop

Fig. 1—An air-operated device to bend pipes. Several sets of dies with convex and concave mating surfaces, grooved to fit pipes of different diameters, are employed to make bends to the required radii

Fig. 2—A small, but effective, screw press mounted on wheels. This press may be used to bend sections that are too heavy for the air-operated device. The piece here shown is a quadrant for a reversing lever

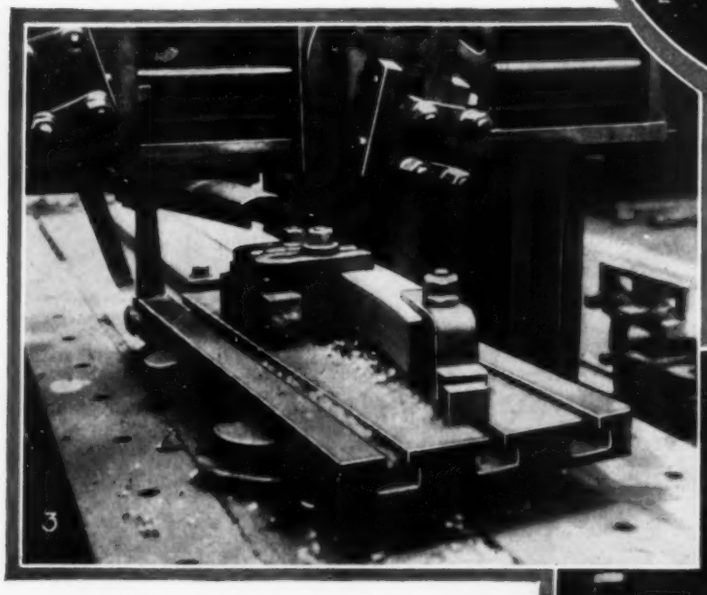


Fig. 3—A device to produce circular arcs on a planer. Instead of a long radius bar extending to one side of the planer, this device is oscillated by means of a roller traveling in a channeled guide

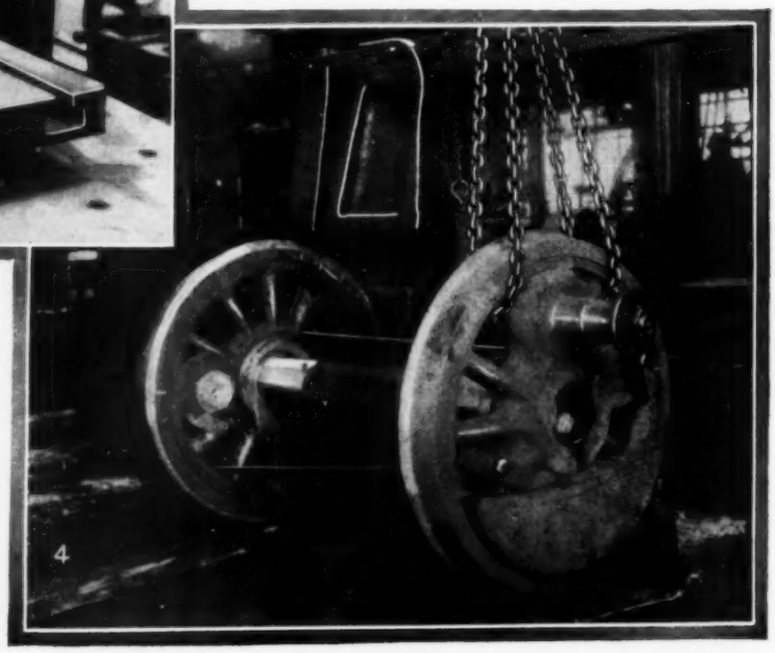


Fig. 4—A pair of old driving wheels fitted to a new axle. It is essential that the crankpins be "square" with each other, often involving an offset key. A model key is made of lead to get the shape required

The Standard-Taper Problem

A few of the reasons given by advocates of the adoption of a new taper as a standard for machine spindles and the shanks of small tools

TIMES change in machine building as in other industries. The standardization of machine tapers is now receiving careful attention in many quarters, which is in marked contrast to the number of responses received to the inquiries regarding the subject sent out by the *American Machinist* late in 1921. There is also a change of opinion as to which taper would be most acceptable. The answers referred to, which embodied the experiences, opinions and traditions of a wide variety of users, showed a preference for the Morse taper, with the Brown & Sharpe a good second and the Jarno also in the running. Since the publication of these answers in 1922, there has been a decided movement in favor of the standardization of one taper and the proposed taper of $\frac{3}{4}$ in. per ft. has found many advocates. In fact 54 per cent of a large number asked favored that taper, while 75 per cent favored the adoption of a single taper and 71 per cent agreed to adopt the recommendations of the committee. The primary object of the taper on drill shanks, lathe centers and milling machine arbors and cutters is to center them in the spindle or collet. The taper was originally intended for driving drills and cutters. But the early adoption of the tang on the end of the shank is good indication that the taper alone was not entirely successful as the driving medium. And the thousands of twisted and broken tangs prove that the tangs did not solve the problem.

For lathe centers and similar uses where the pressure of the work holds them in place, the steeper taper has two advantages; there is less tendency to swell the spindle from heavy end-pressure and they can be removed more easily. For these reasons the Morse taper of $\frac{5}{8}$ in. per ft. has been largely used by lathe builders, although a few of them use the Jarno taper of 0.60 in. per ft., while Wm. Sellers & Company standardized on a $\frac{3}{4}$ in. taper per ft. as far back as 1862. Drilling machine spindles generally have the Morse taper but cases have been reported where the drill pulled out of the socket or spindle when it broke through the hole.

In milling work, however, where the taper is depended upon to hold the arbor or cutter in place, a taper of less angle is desirable and is absolutely necessary at times. It is for this reason that the Brown & Sharpe taper of $\frac{1}{2}$ in. per ft. has been largely used in milling machines and similar places. This, however, is not universal, as two large builders of milling and hobbing machines are using the $\frac{3}{4}$-in. taper with complete success. In both of these cases, however, the taper is not depended upon to hold the arbors or cutters in place, but a draw-in rod or bolt is used for this purpose.

Objection to the proposed standard of $\frac{3}{4}$ in. per ft. comes from two sources—those who do not wish to change present practice, and those who wish to adopt one of the present standards. One strong argument against the latter course is that neither the Brown & Sharpe nor the Morse tapers are standard, in the sense of being alike in the different sizes. While they are supposed to be $\frac{1}{2}$ in. and $\frac{5}{8}$ in. taper per ft. respectively, the exact taper holds true in but few of the sizes. In some cases the tapers vary as much as 0.03 in. per ft. or 0.0025 in. per in. which is sufficient to prevent a good fit and to ruin a spindle or collet for accurate work. It is also interesting to note that the large, or Magnum, taper of the Brown & Sharpe Company is $\frac{3}{4}$ in. per foot. There is little doubt as to the inability of the proposed $\frac{3}{4}$ in. taper to hold milling cutters satisfactorily unaided. Milling cutters are very apt to jar loose when held by the taper alone. And this also holds true for the smaller Brown & Sharpe taper. But it is difficult to see why one, comparatively small use of a taper should decide its selection. After a milling cutter shank is in place it does not take much pressure to hold it there, and but little if any more in the case of the $\frac{3}{4}$ in. than of the $\frac{1}{2}$-in. taper. A simple draw-in rod, which should perhaps be called a "hold-in" rod, answers every purpose.

> Some of the reasons in favor of the proposed ¾-in. taper are: To have the taper uniform on all sizes instead of the variations that now exist. To have a taper that will not tend to spread the spindle hole, or that will not stick and so prevent its easy removal. To have a taper that cannot be mistaken for the tapers now in use or be misused in present spindles

To those who object to tapping a hole in the end of a small shank, it is suggested that an external thread on the end of the shank and an internal thread in the hold-in rod will do just as well. For twist drills, the tang on the end of the shank has been replaced in some large shops by flats at the large end of the shank. Others have keys of some sort and Sellers still maintains the key the whole length of the shank. It is pretty generally conceded that the taper should not be used for driving except, perhaps, with light cuts.

The length of the taper is another factor that deserves consideration. Here, too, the question of driving by the taper alone plays its part, as a longer taper is necessary where it is depended upon for driving the tool, than where the taper is merely for centering. The steeper the

taper, the longer it must be to secure the same holding effect. But, as before pointed out, this is but a minor requirement of a taper when the whole field is considered, and most large users agree that other and more positive methods of driving should be provided, especially on large sizes. For small milling cutters, the usual holding-in devices seem to answer although other and more positive driving methods might be adopted.

The Jarno taper has the advantage of indicating its three main dimensions, the two diameters and the length, from its number. It is believed by some that the proposed $\frac{3}{4}$-in. taper can be laid out satisfactorily on a somewhat similar basis.

One of the main reasons for advocating a new taper instead of adopting and modifying either of those in common use, is to prevent the use of tools with the new shanks in the old taper holes or vice versa. The difference in some cases would be so slight that a careless workman would drive the new shank into the old hole and thereby distort it, or, if it failed to hold, would probably score the taper hole in the spindle or collet beyond repair. This would be impossible with such a radical change as the $\frac{3}{4}$-in. taper per ft. There seems to be little doubt that large users of machines and tools in which taper holes in spindles and collets and taper shanks on centers and tools play an important part, desire this standardization. Apparently the proposed taper of $\frac{3}{4}$ in. per ft. is satisfactory to most of them. The fact that this taper is already in use by three well-known builders of machine tools, indicates that there can hardly be any valid objection to it.

Many users stand ready to adopt whatever standard is decided upon. On the other hand, it is not to be expected that all of them will do so immediately. One very large user insists upon the Jarno taper being supplied on his machines, and it is quite probable that he would adopt the $\frac{3}{4}$-in. taper just as readily as any other, if he decided to make a change.

Standardization of tapers is evidently on the way and should be carefully considered by all. The user is the one who will ultimately compel its adoption by demanding it in his machines and tools. The obvious duty of those who have the welfare of the industry at heart, is to study the question carefully and direct the standardization along sane and satisfactory channels. Mere opposition, as in so many other cases, does not prevent a coming change, but frequently results in the adoption of undesirable measures.

Those who wish to help the industry should keep in touch with E. F. DuBrul, general manager of the National Machine Tool Builders' Association, who is chairman of the Technical Committee that is undertaking this work. Communications should be addressed to him care of the A.S.M.E., 29 West 39th Street, New York.

Packing for Export

By Paul L. Grady

SECOND only in importance to the American exporter selling his products in the foreign markets of the world to getting paid for them, is for him to pack them properly that they may arrive in an undamaged condition and be useful to his customer. The point was stressed by the author at the fifteenth National Foreign Trade Convention on April 26 at Houston, Texas.

The enormous growth of our overseas trade since the war has tended to increase the number of exporters. Some of these are inexperienced, with the result today there is merchandise consigned to foreign markets packed in containers that little more than meet the railroad's minimum requirements for domestic shipment. On this point, John F. Keely, of the Transportation Division of the U. S. Bureau of Foreign and Domestic Commerce, said in his volume "Packing for Foreign Markets," published by the U. S. Department of Commerce, "It is an axiom that proper packing can be done at an expense that will show an actual saving over inefficient methods. 'Cheap' packing has always proved false economy and is a detriment not only to the individual exporter but to our entire foreign trade as well."

Packing of a kind that will be satisfactory for one country or destination, may not be at all suitable for another. At many ports of call, and this extends to all the different sections of the world, there is an absence of port facilities that calls for packing of a very substantial character. In such instances the steamship is anchored in the open roadstead and the cargo discharged into lighters or barges for delivery ashore in weather of various sorts. It is encumbent upon the exporter to know the facilities of the port where his goods are consigned so that they may be properly packed.

As steamship rates are based upon volume as well as weight, it is usually advisable to resort to compression, nesting and knocking down to conserve in the cubic measurement of the shipment where such practices will not result in damage to the goods shipped.

In addition to boxes and crates, merchandise is successfully exported in barrels and certain merchandise can be baled to advantage. In selecting a container, there are at least six important factors. The exporter must keep these facts in mind:

1. The container must be adequate to protect against damage from handling, which includes reasonable assurance from puncture
2. It must be of such construction as to discourage pilfering
3. It must offer protection against climatic changes and adverse weather conditions

He should also bear in mind:

4. Its effect upon transportation and insurance costs
5. Its effect upon the import duties of the country of destination
6. Its actual cost.

Although the outside container may be adequate to withstand every hazard it may meet, if the merchandise is not properly packed in the container, it may be damaged. Ways of bracing must be employed so that articles can not shift or absorb shocks. Wood blocking is effective for strong, heavy articles while sawdust, excelsior, etc. is effective for packing fragile articles. Damage from moisture can be obviated by the use of tin or zinc linings or waterproof paper.

Improper marking of shipments causes tremendous losses every year. Stencils from 2 to 5 in. in height should be used together with a black waterproof paint. Brush marking is ordinarily unsatisfactory. Unnecessary marks make the address difficult to find and read and advertisements help the pilferer.

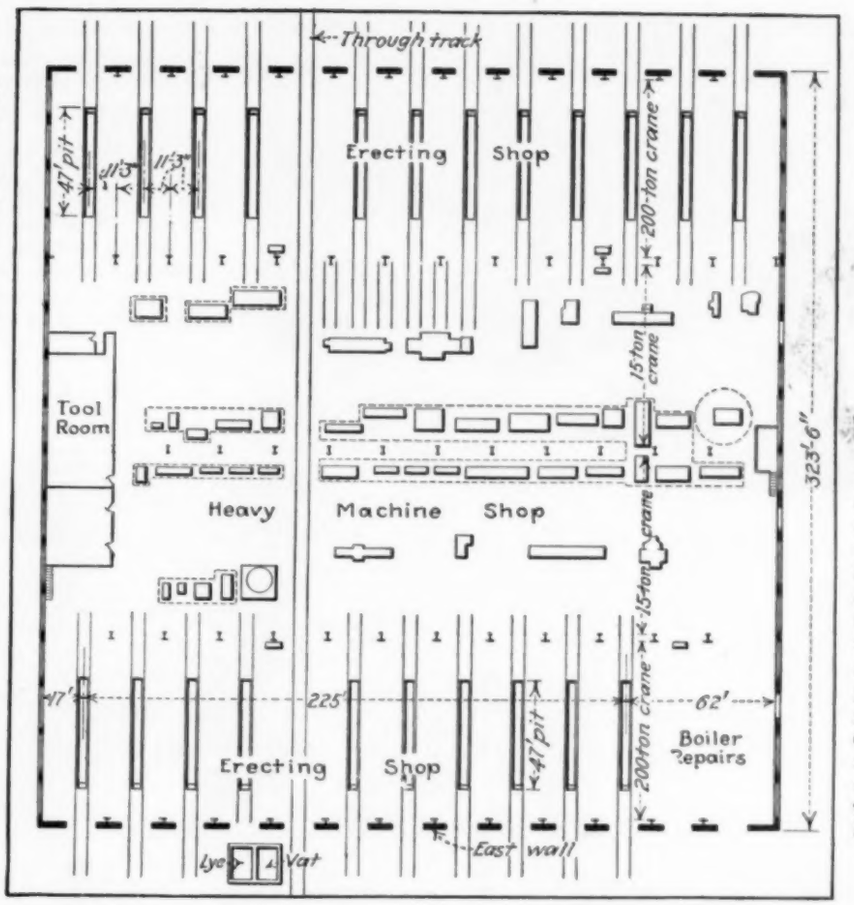


Fig. 1—A locomotive shop arranged as a twin shop having two erection departments and two machinery bays. Such a layout eliminates the long distance haulings usually encountered in this class of work

Two 200-ton cranes serve the erection departments while two 15-ton cranes handle movements of materials in the machinery bays. Each erection department has 12 pits of which two at the east end are of the flat type and arranged to accommodate heavy boiler work

A Twin Shop for Locomotive Repairs

By Frank W. Curtis
Western Editor, American Machinist

LAID OUT in a manner somewhat out of the ordinary, the locomotive shop of the Southern Railway System at Atlanta, Ga., has two sets of transverse pits arranged at the east and the west sides of the building, which are separated by a machine shop having two individual bays. In reality the shop is a double one, as shown in Fig. 1. Both erection bays are 82 ft. in width, while the machinery bays are each 80 ft. in width, the length of all being 304 ft. The two 200-ton cranes and two 15-ton cranes serve the shop, the larger cranes operating in the erection departments and the smaller ones in the machinery bays. One of the features of the layout is the ease with which materials are handled in that long-distance movements are not necessary.

The erection shop at the west side has 12 pits that connect with tracks leading to the yard. One of the tracks runs directly through the machine shop to permit the engines to be transferred to the erection department at the east side, which has 10 working pits and two boiler tracks of the flat type. Transportation of power to available pits at this side is handled by crane. In routing the repair work the practice is to place locomotives requiring heavy boiler repairs in the east section, whereas the west side is used mostly for general repairs.

The machinery bay shown next to the erection shop in Fig. 2 handles driving wheel, axle, driving box and similar work, and the other machinery bay, illustrated in Fig. 3, handles such parts as rods, motion work, guides and crossheads. These views give a general conception of the outline of the shop, the arrangement of machinery, and the relative position of the pits on either side. The shop is well ventilated, is bright and has a cleanly appearance since racks and stands are provided for the storage of parts undergoing repairs. All machines are equipped with individual motor drives.

The toolroom is located at the south side of the building. A balcony over the toolroom houses the air-brake department. Blacksmith, boiler and tank work are handled in separate buildings located conveniently to the locomotive department.

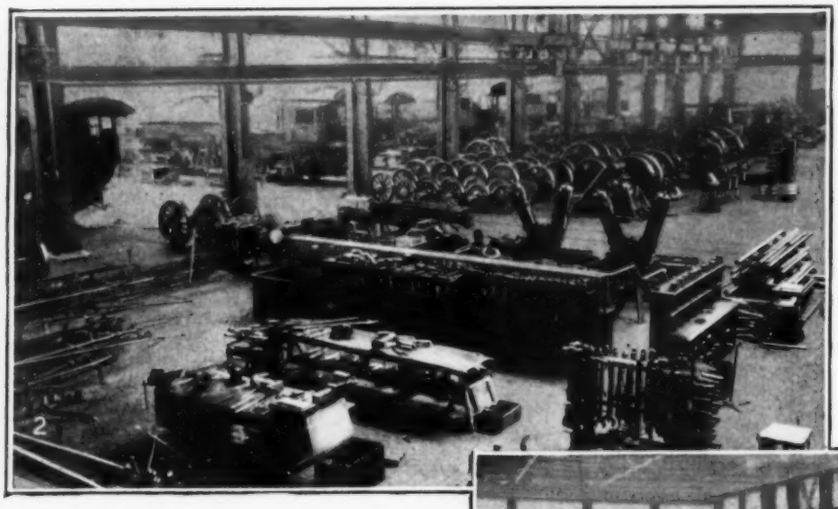


Fig. 2 — The machinery bay at the west side of the shop showing one of the erection departments at the extreme left. Driving boxes, axles, wheels, and stokers are some of the parts repaired in this bay, which measures 80 ft. in width by 304 ft. in length. The pits of the erection department are connected with tracks leading to the yard

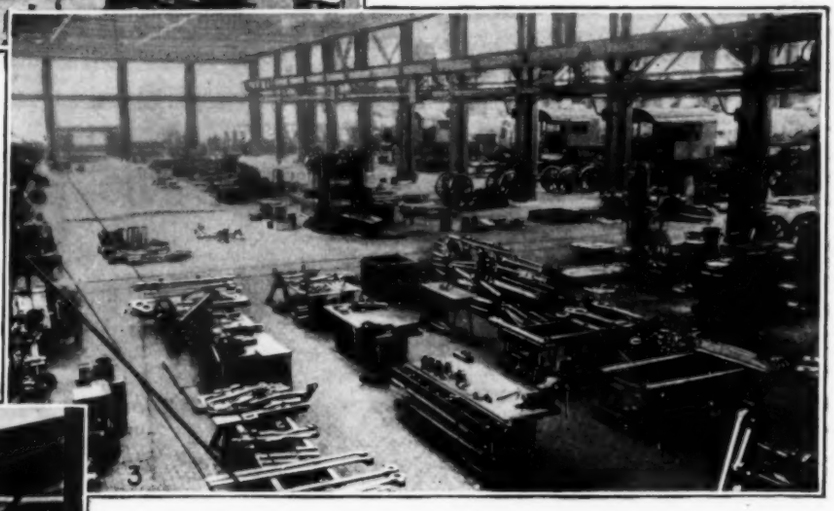


Fig. 3—Measuring the same as the west bay, this department handles connecting rod, motion, guide, crosshead and similar work. In the foreground is shown the through track over which locomotives are transferred to the east erection department. Disposition to an available pit is handled by overhead crane. All machines are equipped with individual motor drives

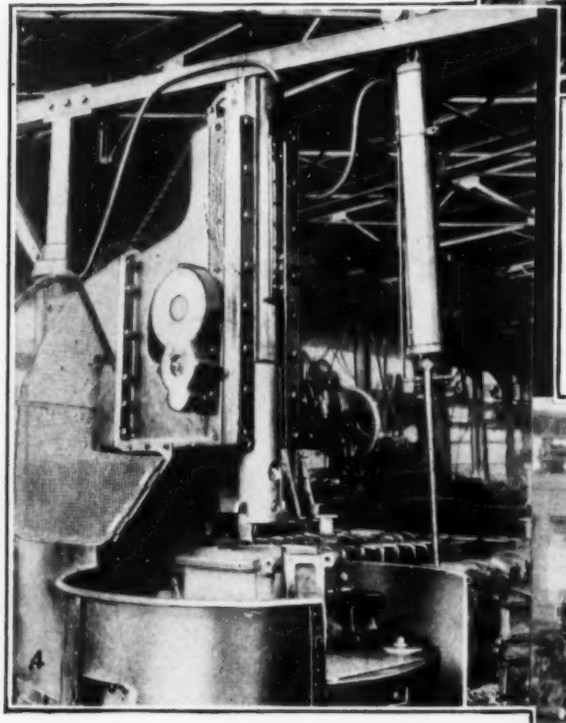


Fig. 4—Some of the heavier machines are equipped with individual jib cranes and hoists. A machine of this type is the driving-box boring mill illustrated showing a set-up for the boring and the facing of a driving box. The work is handled by a two-jaw chuck and a hinged screen is attached to the machine to prevent chips from being thrown on the floor

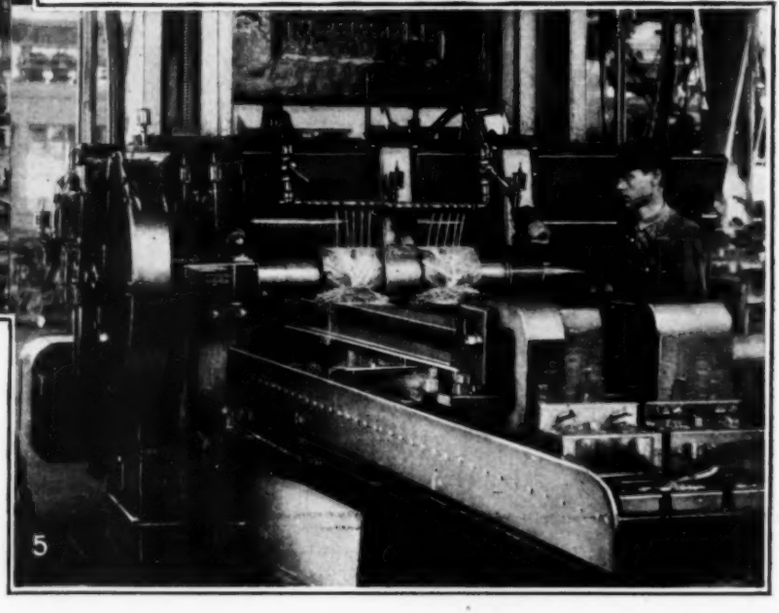


Fig. 5—The connecting-rod department is conveniently located in the central portion of the shop and houses adequate equipment to repair old rods as well as to take care of the construction of new ones. One of the machines is a slab miller, equipped with fixtures for channeling and face-milling operations. The set-up shows four rods being edge-milled simultaneously

Working facilities in the locomotive department include electrical, water, steam and air connections at each post along the pits, with additional electrical connections at the pits for drop lights and the operation of miscellaneous tools.

A Sellers boring mill is shown in Fig. 4 set up for facing and boring a driving box that is held in a two-jaw chuck. A jib crane and an air hoist of the built-in type are shown overhead, enabling the work to be loaded independently of the traveling crane. At the left may be seen a hinged screen that is used to prevent chips from being thrown on the floor while the machine is in motion.

Connecting rod work is handled in the central portion of the machinery bay adjacent to the east erection shop which is conveniently located to all pits. Among the equipment in use for this class of work is the Ingersoll slab milling machine illustrated in Fig. 5, which handles the channeling and facing of new rods as well as the reconditioning of used units. The set-up shows two sets of main rods being slab-milled at once. The same fixtures accommodate rods requiring channeling and face-milling operations.

Why Production Guaranties?

By George Connolly

A TYPICAL transaction will serve to show that production guaranties have become a bugbear to not only my concern but to many other machine-tool builders. We receive an inquiry which asks for price, delivery and production guaranteed and states "inclosed find blueprint." With more business in sight and pencils all sharpened, the word is, "let's go."

We figure feeds and speeds, compare with other jobs and finally have a "production estimate." We send out our proposition with the seemingly protective clause, "if the stock removal is not more than $\frac{1}{8}$ in., the production guaranteed is so and so."

Perhaps we are not satisfied with the information given in the print or with a sample submitted, so we decide to send for a quantity of parts for a production test. How often do we get a quantity sufficient to get a real test? Seldom, if the parts are bulky. The customer may not be able to spare many and it may be a new job for which he is tooling. Do we insist on getting the parts before submitting a guaranty? Not when business is slack.

Let's suppose that we do get some parts. If they are intricate in shape, special fixtures may be required to handle them properly, special cutters may have to be used, or grinding wheels obtained. We can't go to the expense of tooling up especially for the job, so we go

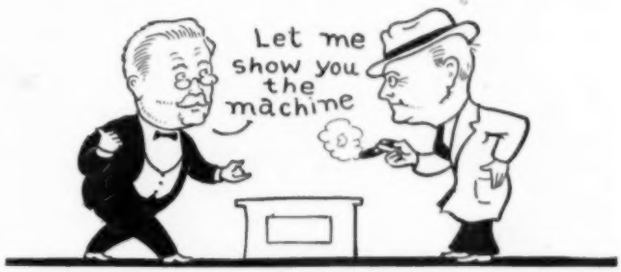
ahead as best as we can, but go easy on cuts as we don't want to send back any spoiled work. That takes a lot of explaining, sometimes.

Well, out goes our proposition, stating that with this or that tooling production will be so and so. We've padded our figures a bit perhaps, believing that once we get the swing of the job we shall do better than in the test. This sounds rather familiar so far, doesn't it?

The customer has been put to no expense, since the cost of sending samples is repaid by the labor represented in the finished parts returned. The manufacturer, however, has expended money in proportion to the difficulties of the job. He has gambled on the prospective sale. However, the expense involved is reflected in his cost figures.

Well, we get the order and the machine is finally shipped. Then comes a wire for a demonstrator, since the machine is not producing up to the guaranty. Out goes our man to Detroit, Chicago, or Cleveland, with nothing else to do. Along with him goes our profit.

A piece must come off the machine every thirty seconds. We find that half of the time is consumed in



loading and unloading. We cannot speed up on the machining time, since that's satisfactory, so to get production the work must be handled faster. "You guaranteed 120 and hour and we've got to get that or out goes the machine," is the ultimatum. So our demonstrator sticks around while expense mounts up, and perhaps we have to keep another customer waiting until he can get away. Also the man selected to operate the machine may not be just the right person.

Perhaps the job represents a difficult tooling proposition. The fixture designed and shipped with the machine will not stand up without continual adjustment. The machine is the right one for the job and the guaranteed production can be obtained but the accuracy desired cannot be met. Will the customer accept the machine and build his own fixtures, since he has a tool design department? Certainly not! He demands the guaranteed production in the face of all obstacles.

Perhaps the job is one on which our guaranty was away off. Never mind the reason, even the best estimators miss once in a while. We can get but three-fourths of the production guaranteed and this after weeks of effort on the part of our man. His usual stay is three or four days. Perhaps some one else goes out to look at the job, adding more expense. The machine, as it stands, produces more than the equipment previously used, is easier to operate, will effect a saving in part cost, and is more flexible in the range of work that it will

handle. "But you guaranteed so many an hour and we expect you to make good," is the comeback. There you are!

In each case the machine, fundamentally, is right for the job. The installation is making a saving in cost for the user and yet he does not have to spend a cent, unless he wants to, in assisting the seller to make good his guaranty. If the machine is thrown out, due solely to not making good on the guaranty, it is the fault of the estimator. However, the stigma of rejection follows the machine and the happening may serve as ammunition for your competitor. Thus prejudice is built up, one customer's good will is lost, and there has been a heavy direct expense which ultimately gets into the cost of the product.

Even if the machine were accepted without production being up to the guaranty (let us say here that not all buyers of tools are unreasonable in this respect) a lot of expense has been incurred which may leave little if any profit in the sale. Relations between the seller and buyer may be slightly strained, and there is a reasonable chance that the next order will go to a competitor, to see what he can do.

One Solution to the Problem

When making an estimate demonstrate or show machines in operation in some plant. The buyer thus checks the estimate with his own observations, and when an order is placed nothing should be incorporated therein regarding production guaranties. The order then becomes a simple contract containing machine details, price, delivery and terms of payment. A man may be sent to start the machine and spend some time in instructing the operator, if this is in line with regular practice. The expense should be reflected in the price of the machine. However, there is no compulsion that the demonstrator stay an unreasonable length of time, even if the machine does not come up to expectations when first started. Neither has the buyer any legal right to withhold payment when due.

When a buyer has seen a machine performing before ordering, and believes that it is adapted to his work, he wants to see that the machine makes good to vindicate his judgment. The machine, therefore, is apt to be recognized immediately as plant equipment and possibly the attention of his own engineers is directed thereto and suggestions made as to tooling. No manufacturer of machine tools today presumes to know it all, even about his own machines, because things are moving so fast. Suggestions for set-ups are best originated from those watching machines constantly in operation. The user has a big advantage in that he can, if necessary, make changes in parts to better adapt them to machining, reverse sequence of operations, and sometimes change tolerances.

Today the tolerances allowed and the finish required are such that with some types of machines it is impossible to tell just what a machine will do until it is set up and working under the factory conditions of the buyer. Why, then, should all the burden of performance be placed on the manufacturer?

The smallest number of cars, trucks and buses registered in any geographical division in 1927 was 10, in the Seychelles Islands, off the African coast. The largest number, 23,253,882, was in the United States.

SEEN · AND · HEARD

By John R. Godfrey

Aviation engines— "I" and "We"

IT SEEMS a bit odd that more automobile concerns have not gone into aviation. There are probably two reasons, one, that they have had their hands full with automobiles and, the other, that those who have tackled the airplane engine problem have found many conditions that differed widely from automobile practice. Of course all motor builders expect their motors to keep on "moting" until either the spark or fuel supply is cut off. But if they quit it means no more than some cussing on the part of the driver and a phone call to the service station. In an airplane it means hunting a place to land and no time to lose in doing it unless the plane is unusually high.

Take for example the clearance between the piston and the cylinder bore. In automobile motors this averages about a thousandth per inch of diameter even with the aluminum-alloy piston when the skirt is split, as is now common practice. Such a piston does not slap, even when the engine starts up cold, and does not overexpand.

Aviation engines on the other hand are using solid pistons and from three to four thousandths per inch in diameter is allowed for clearance. Why? Because the solid piston conducts the heat to the cylinder walls more rapidly and the noise of the slap of a cold piston is not objectionable as yet, owing to the other noises of the power plant, such as those of the exhaust.

It may be asked why, if the split skirt is O.K. for automobile motors, it is not good in the airplane engine. But it must be remembered that the automobile engine runs normally at perhaps twenty per cent of its maximum power, while the aircraft engine cruises at about seventy-five per cent of its power. Furthermore it uses full throttle more than the motor in the car and has much more severe service in every way.

Problems like these probably explain why more automobile engine builders have stuck to their knitting and are letting the other fellow develop the aircraft engine.

* * * *

I can't help wondering just what is responsible for the "I" habit, or should I say, complex? In a shop the other day, the foreman was showing me the way the work traveled from operation to operation. But in every case "he" did all the work. "First I bore this hole, then I take it to the next machine and ream in this fixture I made"—and so on down the line. If he hadn't been so specific I should have supposed the men were doing the work, but my eyes must have deceived me.

Of course it's nothing but a figure of speech, but it doesn't help make things any smoother in the shop. It's just as easy to say "we" and it tones up the morale, or whatever you want to call it. Whenever I hear the "I" tooted too loudly by the man in charge, I begin to wonder if it isn't a sort of whistling to keep up his courage, and to make him think he really has a hand in everything.

If anybody had a license to say "I," it was Lindbergh—but how much wiser he was to say "we" and include all who helped make the flight possible?

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

How Much to Spend for Repairs?

"SAY, Al, I got a terrible cold shoulder this morning from Williams on that milling machine repair job."

"How was that, Ed, I thought you were priding yourself on that job?"

"Well, I did think I had a dandy job, and showed him the repaired machine back at work—new bearings, new spindles and gears, and the table and ways re-scraped and lined up. Looked like new, too. I didn't intend to have so much money spent on it, but one thing led to another after they got it into the maintenance department and I told them to give me a good job."

"What did Williams say?"

"He said darned little, but he sure acted his feelings. Shrugged his shoulders first, and told me a story about a Scotchman who wore out a seven-dollar pair of shoes to save two dollars carfare. Then he said it was his own fault for not having a better program for maintenance work."

"Wonder if he isn't right both ways, Ed? Shouldn't be surprised if he comes out with a general order on maintenance soon. But don't take it to heart, you're just the one speeder that got picked up as an example. Guess we've all speeded at times."

"But how do we know when to stop on repair work, Al?"

"We don't, Ed, and it's not up to us to say, as I see it. That's why I think we're going to see a G. O. come from the super's office. The amount of repair work to put on a machine depends on many things. I know of one shop building sugar-mill machinery that has a slack season in the winter, and it uses its men to give a thorough overhauling to the shop equipment. But if there is no slack season, and extra men must be hired for the overhauling, it pays better to buy new machines than to make any extensive repairs."

"But how about Jones' shop over in Westville? You know he rebuilt a lot of machines there."

"I know, Ed, but that's what the professors might call 'economic necessity.' That shop where Jones is foreman belongs to a railroad that hasn't been showing a profit, and the company didn't put anything in the budget last year for new shop equipment. Jones told me it was a matter of repairing at any cost. He could put his men on rebuilding the machines, but he didn't have any money for new ones. Told me of one case where he spent four hundred dollars to repair an old machine, when he could have replaced it with a new one of better design for eight hundred."

"That's worse than anything we do, Al, but still I think it would have taken a big line of argument to get up to the big guns that we needed a new milling machine to replace that old one. I don't like being the goat in the case, but I'm anxious to see what will come out of it."

"Don't worry, Ed, Williams will not mention that you were the 'horrid example,' but he'll get busy soon, that's certain. You just watch for that order to come out."

How does the foreman know when to order repairs and when to recommend buying? Williams feels that a general plan for the shop is necessary. What should he arrange?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Something Besides the Pay Envelope

A BENEFICIAL means in the promotion of interest among the workers is the stock purchasing plan. Under this plan the worker becomes part owner of the enterprise in which he is employed. Stock ownership is a means of reducing labor turn-over. An interest in the welfare and success of the company will be stimulated, and the paramount desire of the workman will be to increase the profits of the business through reduction of costs and greater production. —H. KAUFMAN.

Promoting Interest Among the Boys

IN SHOPS manufacturing ordinary equipment it is often difficult to stimulate interest because the work itself does not go into a colorful machine. Recourse must then be had to other things immediately concerned with the plant. Many companies have aroused pride in the shops by encouraging care of the grounds and by permitting various gardening activities concerned therewith. Others create a friendly attitude by industrial athletic teams, clean surroundings, or gymnasiums. Although I believe a foreman should enlighten the boys, I have endeavored to use other plans for promoting interest which include features for not only boys but the men in the organization. —ROBERT MAWSON.

MOST boys respond to careful advances from an older person such as a foreman. Possibly only a small percentage will evince any lasting interest, but even these few are worth developing. It may be that later they will go to some other plant, but if this policy in question is general we should expect to receive others to replace them. At least, if we are to have a good body of enlightened workmen in the future, we must lay the foundations now. —R. A. TARBUTTON.

IT SEEMS logical to me to start promoting interest among the boys since they have the most receptive minds, and are without the tendency to find fault with such work as exists among older men. Of course, the competition of outside interests is heavier but this should act as a spur to those who are striving for their interest to present their information in a highly popular and interesting manner. It must not be lost sight of that the boys are the foundation on which the future of any industrial organization is built, and that they are by nature boosters for anything on which they are sold themselves.

THE · NEXT · TOPIC

Monthly Checks on Workmen's Ability

ADVANCE QUESTION

Williams has introduced a card questionnaire to have foremen check their men's qualifications each month. Neither Al or Ed is sold 100 per cent, but Al can see some good points. Ed doesn't see any. How about you?

Al can hold the interest of these boys after they have been organized by inviting the executives of the various departments to give them an insight into their work. By presenting a complete picture of the activities of each person in the organization, and by showing the correlation of these activities, the boy's field of vision is bound to expand. When the possibilities in a concern are shown to an ambitious boy it is likely that he will set a definite goal to work for rather than be content to drift along. —G. L. MAHON.

Helping Tony Celebrate

ASSUMING that the foreigners in Al's department are enlightened and not of the ignorant type, I don't believe that Al will gain a great deal of respect or co-operation by wearing a flower or any similar manifestation to celebrate a foreign holiday. On the other hand, the average workman would feel that he was being "kidded" by the foreman if a flower were worn; a practice that smacks of the small town politician.

There are so many legitimate ways of gaining workmen's respect and co-operation that it should not be necessary to resort to the above-mentioned practice. Taking a kindly view of a workman's mistakes and helping him prevent a recurrence of the same, instead of harshly critizing him, will do far more towards creating the proper attitude. Furthermore, giving raises and promotions as soon as they are earned will go a long way towards the desired end. But above all, a foreman should be natural in his conduct and genuinely interested in his men, for if he is otherwise, the workman will soon find it out, and his authority will be despised.

—A. CADDIE, *Canada.*

IT IS all right for Al to sympathize with his foreign-born workmen when they are celebrating a natal holiday, but he should be careful not to imperil his dignity to the point that he loses all authority. When such events happen it is well to express interest, but not permit production to be interfered with. Oftentimes foreigners like to take time from work to celebrate, and this should be discouraged in a tactful manner if possible. However,

losing a few hours' time of a skilled workman is less costly than letting him go altogether unless insubordination occurs. —F. E. BIRD, *Canada.*

THE fact that Al has the confidence of his men in that they sought his approval of their plan to observe their holiday, speaks well for his ability as a leader. He recognizes anything that will help create a spirit of loyalty and friendly co-operation among the men is good policy on the part of the foreman, as long as it does not cause them to lose respect for him. Of course, when it comes to lay-offs, and where production would be hindered or interrupted, it is up to the foreman to keep the men on the job. —C. H. LATTNER.

THERE are several nationalities among my workmen, and I take an interest in all. I have made it my business to learn about their native countries, and the reasons for holidays and certain customs. In this way I have built up my knowledge of each type of foreigner and at the same time have been rewarded with their co-operation. Moreover, I have penetrated into their home life. Not only has better workmanship and loyalty been aroused, but social conditions have been improved. —J. J. KUBISTA.

Training the Foremen in Management

ONLY as the foremen are able to interpret properly the policies of the management to the men will their leadership reach its highest value. It is, therefore, to the best interests of the organization to instruct its foremen in the fundamentals of management that they can use. Many a worthy plan for foremanship training submitted by the management has fallen through because of the indifference or antagonism of those for whom it was intended. This is due, in most cases, to the failure of the foremen to understand the motive behind the action. —C. H. LATTNER.

FOREMEN are representatives of the management, and as such in my country have their own organizations as provided for in the by-laws of the working men. The foreman has varied duties in many concerns. In connection with production it is his duty to increase it while improving it, and also to hold down costs. Then he hires and discharges men and sets wage rates. Is it not natural, therefore, that the company has the right to employ compulsory training to make such a person more fit for his duties? —FAUSTO RECERRIL, *Mexico.*

He Never Asks for a Raise

THERE was no reason for Ed to be angry when Bill Hankins left because he was not being paid what he was worth. If Ed had given Hankins a raise at the right time, the incident would have been averted, and Ed would have shown good business judgment. Ed should learn that men must be checked constantly as to the quality and quantity of their work, and be paid accordingly without delay or bluster. —W. C. BETZ.

MANAGEMENT, I have noted, is more apt to give a raise voluntarily, than when it is demanded, or when it has been implied that value received in workmanship has not been paid for. I am familiar with two cases similar to that of Bill Hankin's that occurred some time ago in which the company was not willing to offer an increased rate to keep these men even though their immediate superiors had interceded in their behalf. The company was willing to let the experienced men go and choose others for the same jobs which then had to be re-rated to cover the increase desired. It is my opinion that if these men had discussed matters quietly with their foremen and not given notice, the management would have been willing to consider the increases desired. —D. W. BICKEL.

IN ALL shops there are men who have exceptional ability, and the foreman would not like to see them leave because a raise had not been forthcoming voluntarily. However, many shops are continually losing good men like Bill Hankins because of the short-sighted policy of not giving raises until they are demanded. Much better co-operation from the men in such shops would result if a definite system of giving raises was begun. A slight raise every six months to worthy men would do wonders to the shop morale. —C. H. WILLEY.

MANY valuable men neither know their own value nor have the assurance to assert themselves. Bill Hankins must have been one of these, and he made a mistake in leaving without asking for a raise. If he had discussed the matter with the foreman before quitting, I feel sure that matters would have been adjusted.

Many shops have found that great discrepancies exist between the amounts paid the workmen and the foreman, and in some cases the workmen were getting more than the foreman. Because of these happenings it was found to be good practice to revise the rates once every year. —ENTROPY.

Shall It Be Layoffs or Short Time?

WHY not take advantage of these rare occasions of slack time in a well organized business to weed out the undesirables and so insure a group of highly skilled and conscientious workers? A first class worker can easily find a better place if short time is inaugurated, while the less skillful worker will develop undesirable traits and will lose all desire to improve. It seems to me that short time may be all right for the third rate workman, but not satisfactory for the skilled workman or the company. —W. G. HUNT, *England.*

Getting the Wear Out of Machines

IF ED would carry the comparison between the new machine and his car a little further, he would see the wisdom of the theory that it is good practice to run machinery at its highest safe speed.

He does not drive his automobile at a rate which will prolong its life fifteen years because he knows that improved models will make it a back number in three or four years. He may not have given the matter much thought, but it is nevertheless a fact that in the last five years machine-tool design has progressed almost as rapidly as automobile design. As a result machinery, which still has many years of life, is being scrapped to make room for more modern equipment. —H. KLINE.

· BOOK · REVIEWS ·

PSYCHOLOGY FOR EXECUTIVES. By Elliot Dunlap Smith. Two hundred sixty-two pages, 5½x8 in., cloth board covers. Published by Harper & Brothers, Publishers, 49 East 33rd St., New York, N. Y. Price $3.50.

THERE has been such a tendency to overwork the word psychology, and so much of common platitudes in the published material, that the practical man is apt to condemn the whole subject as a fad. But the author of this book, who is himself a practical executive, has held himself within bounds, and has produced a very readable book that is practical and well illustrated with examples taken from his own experiences in dealing with large numbers of employees. He is one of the few teachers of the subject who recognize the failure of "tests" to give anything more than the momentary capacity of the employee at the time tested. He also recognizes that labor cannot be treated as a commodity, and that general understanding of human nature opens the way to obtain self-expression and true service from men.

The book is divided into seven chapters, taking up separately the analysis of individual character, habits and how to handle them, the forces of personality, the problem of self-control, the group effect in industry, and the causes of conflict. In the appendix is given a chapter on suggestions for studying and teaching psychology, and also a list of good books on the various aspects of psychology. The book should be helpful to any executive who has to come into close contact with, or exercise indirect authority over employees.

THE LOCOMOTIVE. Two hundred fifty-three 5¼x8¼-in. pages. Illustrated. Cloth boards. Published by the Hartford Steam Boiler Inspection and Insurance Company.

THIS book is a compilation of two years' issue of *The Locomotive*, a quarterly publication circulated among the policy holders of the above named company. It contains data concerning all boiler, flywheel and turbine explosions that have occurred in the United States and Canada during the period covered. The illustrations showing the results of such accidents and the accounts thereof, should act as warnings to all owners and operators of power equipment of the dangers that lurk in such equipment unless it is periodically inspected by trained men. Every man responsible for the operation of power equipment, from owner to engineer and fireman should "Read, mark, learn and inwardly digest" the contents of this book.

PROCEEDINGS OF THE AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION. One hundred sixty pages, 5½x8½ in., semi-flexible cover. Published by G. G. Macina, secretary-treasurer, 11402 Calumet Ave., Chicago, Ill.

IN PRESENTING the proceedings of the 15th annual convention of the American Railway Tool Foremen's Association, held in Chicago, August 31st to September 2, 1927, the practice of former years has been followed in presenting the papers that were read and the discussions that followed. Other information includes the opening addresses, a copy of the constitution and by-laws of the association, a list of members, and a list of the officers since the association was organized.

The topics treated are: Standardization of present special locomotive taps and dies; Modern commercial tool equipment for use in railroad shops; Heat-treating methods and equipment recommended for small and large railroad shops; and small tools and devices for the locomotive and car shops. Reports of the standardization committee are also shown. The information will be found useful in connection with railway tool work, and will aid in promoting standard practices for the construction of repair tools and methods, as well as in bringing about the aim of the association which is for higher efficiency in the railway tool service.

EFFECTIVE BUSINESS LETTERS. By Edward Hall Gardner and Robert Ray Aurner. Three hundred eighty-five pages, 6x8½ in. Indexed. Cloth board covers. Published by the Ronald Press Company, New York, N. Y. Price $3.

THIS is a revised edition of a practical book that has already proved its need by an extensive sale. The authors are professor and assistant professor, respectively, of business administration, at the University of Wisconsin. They have prepared their book on the assumption that a letter has to be interesting to be read, and to make it so calls for a knowledge of the art of effective writing, and deftness in applying it. While holding strictly to its function as a serious business message, the letter must also be put in a form that is attractive. The authors have demonstrated their point by themselves making their volume attractive and easily readable.

The book contains twenty-three chapters, each subject-paragraphed for easy reference. The first chapters describe the "secrets" of getting persuasion and a good impression into the letter. This is followed by chapters on how to plan a letter, how to ask questions and make inquiries, and letters of appreciation, congratulation, protest, and censure. Avoiding stock phrases is well covered, and the importance of first and last sentences is shown by examples. The later chapters cover the problems of the practical letters of everyday business, such as sales, collection, follow-up, credits, and business reports. The writers of the book aim to show the reader how to write letters for himself, and they discourage the copying of form letters or the use of stock formulas. The book is one that should be useful to anyone in a business organization who has to do with the preparation of letters or reports.

RECORD BOOK OF BUSINESS STATISTICS. Part II, Metals and Machinery. This 59-page booklet is a remarkable compilation of statistics gathered from various Government and commercial sources, covering the metal and machinery markets for the years 1909 to 1926. The statistics include figures on production, shipments, new orders, unfilled orders, and stocks, and in each case the figures are given monthly, making the book valuable to show fluctuations over a long period of time. Metal classifications are broken down to pigs, bars, sheets, and various commercial units. Machinery statistics are given under the general group classifications. The book measures 6x9 in., with paper covers. It is published by the Bureau of the Census, United States Department of Commerce, and can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of 10 cents.

Foreman Jim Slashes Accident Costs

By Auguste Mathieu

Instructive posters kept the men interested in safety

JIM WHITE was bending over his desk, scrutinizing a sheet of paper.

"I'll be darned," he exclaimed as he finished his attentive reading.

Jim was a foreman—a good one too. Thirty years ago he had started as a machinist apprentice in New England, and because of his ability he had left the bottom rungs of the ladder behind. Now, he directed the efforts of a large force of mechanics.

The plant where Jim worked was progressive, and like many other organizations it was including the cost of accidents on the operating cost sheets of the departments. This change had taken effect a short time previously when a new cost department executive had been employed.

That morning, Jim had a very good reason to be disturbed. The sheet of paper that held his interest was one of the new annual cost sheets, with accident costs included. "It sure did cut into the profits," he thought. "Why!" he said to himself, "I wouldn't mind taking that amount for my next five years' salary."

Jim had never been affected by "that safety first stuff," but these new accident cost figures hit him hard. In his day, a good machinist was known by the number of fingers he had off. Couldn't he boast of a stumped index finger himself where he had been caught in some gears?

The money, he thought, how could it have cost that much? Oh yes, he remembered. There was Mike who had lost an eye at the grinders; Gus who had been drawn around a shaft by his loose clothing; Roy who had been burned by splashing babbitt; John who had been off for weeks on account of an infection. It was all clear to him. He didn't try to remember any further. And all this could have been prevented with a little care. Still, he didn't see why his department should be charged with the cost.

Well! it was no use kicking; there was but one thing to do; improve his record for the coming year. This time he was in earnest; he was going to find out if there was anything to that "safety stuff" he had seen.

Next day at the plant there was a meeting. A few of the older men in the department were called together by Jim, and the bad record was exposed to them.

"We've got to cut down these accidents," exclaimed Jim, pounding his fist, "and I want your help. We're not going to start next month either, but right now. Let's organize a safety committee."

A few months before, Jim's company had joined the National Safety Council. Consequently, he had received a quantity of material about safety and safety committees. He even had a number of accident prevention posters for the bulletin board in his department, but these had been set aside. Forced by the bad record to act, Jim was glad to resort to the safety material he had stored in the lower drawer of his desk. He was going to find out what the posters were really good for. Safety material was distributed throughout the shop, and the safety committee was formed. This committee was to meet once a week to make reports of unsafe conditions and practices, and to make recommendations for preventing them.

What the safety committee members brought in made Jim sit up and take notice more than ever. Jones exhibited a piece of steel that had flown from a mushroomed chisel and had embedded itself in his buddy's face. "Just think men," said he, "if this had struck his eye." He himself had been shifting a belt by hand, "like in

Tool inspections reduced the hazard of flying particles from mushroomed tools

the old days," and a belt clip had caught his ring. Luckily the ring was weak at one point and broke, but still he had a scar to show. One by one the members made other recommendations.

When the meeting ended, some resolutions had been passed: Every Monday morning all tools that could possibly burr or mushroom were to be inspected, and if found defective were to be turned in to the toolroom for repairs. Jim himself was to see that enough belt shifting poles and sticks were on hand, and the committee was to try to discourage hand shifting. Posters were to be displayed to bring out the danger of wearing rings while working around machinery. Resolutions were also passed to improve the housekeeping, and to keep trucks and material out of the aisle. One man was given the responsibility of posting safety material and posters, and he was to change the display each week.

Another week went by, and at the next meeting Fred brought in an apprentice who had a bandage over his eyes. The old story, grinding without goggles, emery

When one of the best mechanics was injured by tripping over a bar of steel, better housekeeping methods were adopted

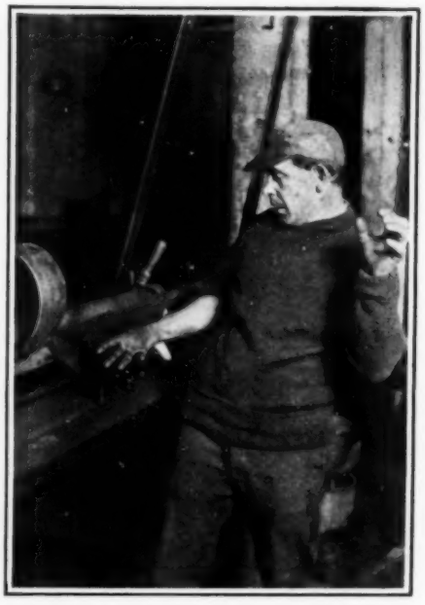
in the eye. "Yes!" admitted Jim, "We have too much of that." Jones reported that his neighbor kept tools in the opening under the planer table and that he had almost lost his arm as he reached for a wrench while the table was in motion. Emil thought it was dangerous to use a file without a handle, and to clean chips off the milling machine with the fingers instead of a brush.

A record was made of all the suggestions and a campaign started to correct the conditions.

Before the month was over every man on the safety committee was campaigning to discourage loose clothing. A few guards had been made for belts, and for other parts of the machinery that were inadequately guarded. Other unsatisfactory conditions were being remedied with all possible haste.

After the men had learned to wear goggles when babbitting and grinding, the eye accidents were eliminated

Nearly six months slipped by this way, and the results pleased Jim. He had changed the committee several times to acquaint other men with safety. He had made purposeless trips to the grinders, and had put on goggles to impress his men with the idea that he meant business. He wasn't one to force ideas down anyone's throat if he could appeal to reason. He believed in the power of suggestion. A few stubborn heads insisted on grinding without goggles, and several of the men insisted on babbitting without protecting themselves. They had done it all their lives, was their excuse. Jim, however, cured them. He ordered a glass eye and had the patternmaker model a neat box for it which enabled him to keep it handy in his vest pocket. When he found a man doing a job without goggles he took out his glass eye, "shall I order one for you?" he would ask. That sure brought the story home to the gang, you can bet!



Gus thought it was easier to keep warm with a heavy sweater than to turn on the steam, until the loose sleeve dragged his hand into the rolls

Details of Jigs and Fixtures

Design of Combination Clamps

By J. A. POTTER

Combination clamps may be made in an infinite number of ways as long as the designer adheres to the fundamental principles

THE working out of a clamping method in combination with a latch, link, or equalizer is a study that is largely governed by the shape and degree of finish on the part which is to be held. The operation to be performed should also be taken into consideration, for a light operation such as grinding will not require the strength and rigidity that would be necessary for a gang-milling operation.

Another point to be considered is the chip problem. A clamping combination consists of two or more parts which must operate freely; therefore, the clamp arrangement should either be covered with a sheet-iron guard, or be located in such a position on the part and fixture that it will be free from chips. Many ingenious single-operating combinations have been discarded for two or more single clamps, because the designer did not give the thought of chips proper attention.

There are two reasons for the adoption of clamping combinations, one being to load and unload parts more rapidly, which would of course include the ability to handle more than one part. The other is to form a combination in which the clamp can be applied at the proper position on the part, getting around such obstacles as an arm, boss, or recess, that would ordinarily be in the way. Of course, speed in handling is a feature, but often one of the removable-type clamps can be used to advantage in such cases. A simple combination is shown in Fig. 1, in which the clamp will swing, slide back, open up wide, and operate rapidly, due to the use of a cam for binding. It can be seen that the clamp will slide back on the elongated slot and open up wide, so that it will swing over the drilled boss and rib, *A*, on the part. When the clamp has been opened to the position *B*, the part can be removed by sliding out in the direction of the arrow, and the lug at *C* will not interfere with the clamp. The notch, *D*, is provided to keep the clamp from sliding back when tightening the cam. The swing stud *E* swings freely, and the distance *F* is just a little longer than the body of the fixture through which it passes. The pins at *G* and *H* keep the clamp from swinging over too far. This combination will enable cast-iron parts to be held in the most favorable position, regardless of ribs, or bosses that may be in the way.

The double clamp combination at Fig. 2, will be found useful for the straddle and gang milling of parts in strips. The two clamps swing on hinge pins between ears on the fixture. The clamp *A*, is operated by a hand screw which forces the pin *B*, against the adjusting screw *C*. The clamp *D*, will open up wide for the removal of the part, as at outline *G*. The pin *B* has a head which rests on the shelf of the fixture to keep it from turning.

A different combination is shown in Fig. 3, in which two clamps act against a steel body, which in turn binds a number of small round parts that are to have a small cut made on the shank, as at *A*. These parts could be milled in a string as shown at *B*, but as the length of table feed and cutting time should be considered, it will be better to alternate them so that they can be grouped closer together. The clamp at *C* is grooved to keep the binding pin from turning, while the clamp *D*, and cross bar handle *E*, are of the usual construction. The steel body is made heavier at *F*, so that any "give" when the clamps are tightened will be uniform on both sides. The block is cut out at the several stations *G*, to give spring at the binding points. A combination that will hold ten round parts securely while milling off a flat, is illustrated in Fig. 4. The double equalizers *C* and *D*, are ground on the ends at an angle, so that the line of force as applied will enable each leg to hold two of the parts, instead of one, which is the usual custom with an equalizer. It will be seen that

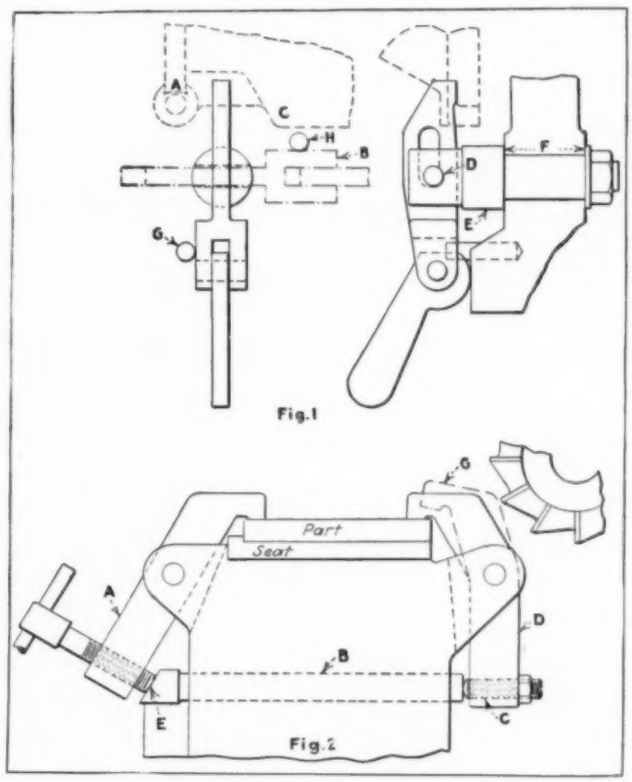


Fig. 1—A simple, fast-operating clamping combination for jigs and fixtures. Fig. 2—Double clamp combination with provision for wide opening, and having a cleared binding screw

The fourteenth and last article of the series.

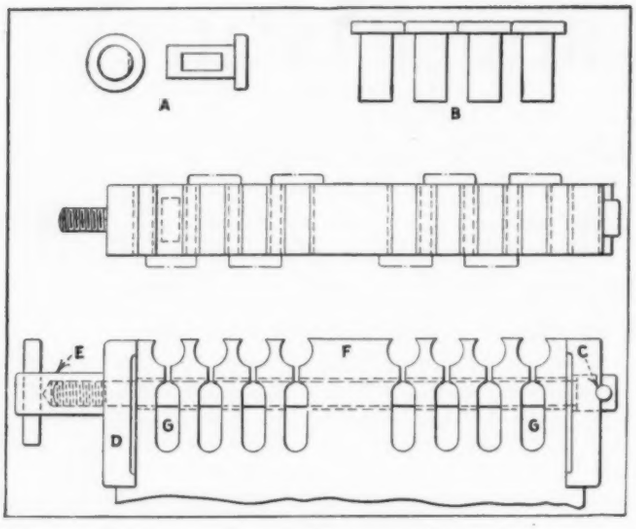


Fig. 3—Line clamp for multiple parts

force the work over against stop on seat *F*. This arrangement will be found useful on lathe, grinding, and reaming fixtures, as it can be built in compact form.

This combination can also be equipped with a link and cross-pin as at *G*, which engages a notch in leaf so that the latter can be thrown out to clear any obstruction on the part. Many combinations can be made up from this principle, another one being shown at *H*, in which two hinged clamps locate and bind the part *K*, when the nut, *M*, is tightened. The latch at *N* can be swung out so that the two clamps can swing out for loading, unloading and cleaning the seat.

The layout of a fixture to hold one, two, or four parts is simple by the use of floating clamps or equalizers. To hold an odd number of parts, however, is more difficult, as it will require either a clamp that depends upon the spring of the ends, or a combination of clamps.

The combination shown in Fig. 6 is unusual in that the binding force is applied in a different manner on each clamp. Clamp 2 has a rounded heel that rests on pad *A*, and is drawn over by the screw stud *B*, clamping

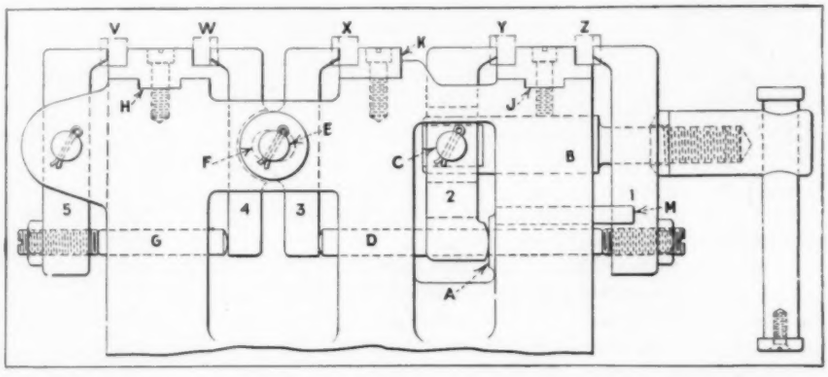


Fig. 6—Combination clamp using different applications of the binding force

the blocks *A* and *B* must be held in place securely, and that they have to take proper relation with the leaf and equalizers. The hinge and latch are of the usual construction, although a nut can be used in place of the cross-bar handle if desired. The binding end is at the left when the operator is facing the machine, so that his hand will be on the opposite side from the cutter or grinding wheel.

A combination that will locate and hold a part, is illustrated in Fig. 5. When the screw with floating shoe is tightened, the leaf *A*, which is free to swing on hinge pin *B*, will be forced out. This being tied to latch *C*, through link *D*, will cause the latch to swing in on the shoulder stud *E*, and the part at *Y*. This stud has a hole through which the hinge pin *C* passes. Clamp No. 1 will then bind the part *Z*, and the tail will be forced over against the pin *D*, operating clamp 3. Clamp 2 is forked on the tail end to provide clearance for pin *D*. The thrust of pin *D*, will swing clamp No. 3 on the hinge pin *E* so that the toe will bind part *X*, but both clamps 3 and 4 being located on hinge pin *E*, with freedom to move in slot *F*, the action will continue. It will be seen that only a slight bind is necessary to put the several clamps into action, but when the handle is brought up tight, all the parts will be held securely. A screw and nut is placed in the tails of clamps 1 and 5, to provide an adjustment so that there will be a minimum movement for loading and unloading the parts. The rest blocks, *H* and *J*, are provided with a tongue as the clamping strain is from both sides. Clamp 1 has two pins, *M*, to keep it from swinging when the binding handle is tightened. The cross bar in the handle is made similar to the bar of a vise so that it can drop out of the way of the machine arbor or cutter.

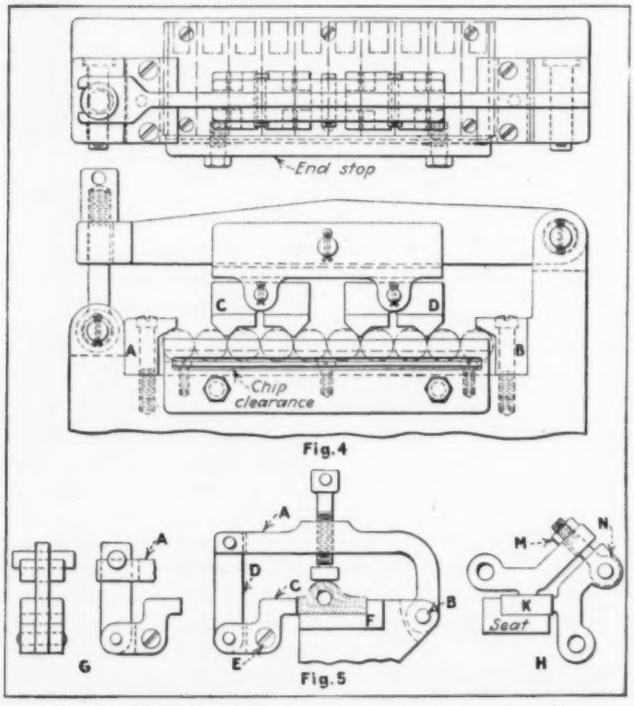


Fig. 4—Multiple clamping of round parts. Fig. 5—Locating and holding with one clamp

Multiple-spindle drilling machines can frequently be used to advantage by dividing the spindles into groups so that several different fixtures can be used under them. As a rule, each group of spindles drills all the holes on one side of a piece, although with very close centers it may be advisable to use two groups for this purpose. In other instances, two or more entirely separate jobs may be handled by the separate groups of spindles.

Bearing Load Calculations for Gears

Spur and Worm Gears

The four types of gearing most commonly used are spur gears, helical gears, bevel gears and worm gears. In addition to radial loads these gear drives, with the exception of spur and herringbone gears, also cause a thrust load. These different loads may be calculated by the following methods.

Spur Gears

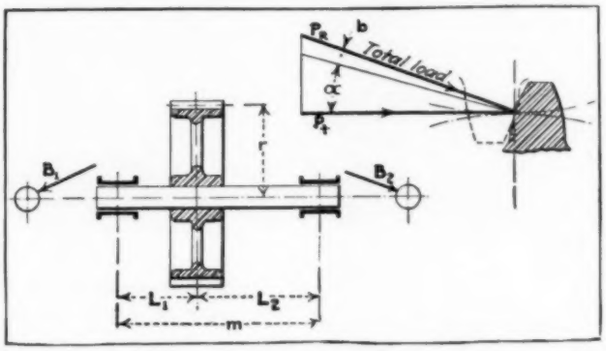
hp. = horsepower transmitted
r.p.m. = speed of shaft
r = radius of pitch circle in inches
a = pressure angle of the gear teeth
b = friction angle of the gear teeth

$T = \frac{63025 \times \text{hp.}}{\text{r.p.m.}}$ = torque in shaft in inch-pounds

$P_t = \frac{T}{r}$ = tangential tooth pressure in pounds at pitch line of gear

$P_r = \frac{P_t}{\cos(a+b)}$ = resulting tooth pressure

Using the resulting tooth pressure as the total radial load caused by the drive, the load on each bearing



can be determined by finding the moments corresponding to the distances of each bearing from the center of the gear.

Worm Gears

a = normal pressure angle
h = lead angle of worm thread

$T = \frac{63,025 \times \text{hp.}}{\text{r.p.m.}}$ = torque in shaft in inch-pounds

$P_t = \frac{T}{r}$ = tangential component of tooth pressure

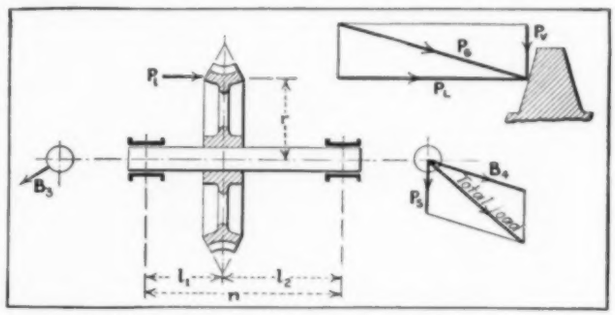
$P_v = P_t \times \cot h \times \tan a$ = vertical component causing a radial load

$P_1 = P_t \times \cot h$ = lateral component causing thrust load on worm

$P_r = \sqrt{P_v^2 + P_t^2}$ = resultant radial load on the worm in pounds

P_t = thrust load on gear shaft bearings in pounds

$P_g = \sqrt{P_1^2 + P_t^2}$ = resultant radial load on gear in pounds



$B_1 = \frac{P_r \times L_2}{m}$ = radial load in pounds on near worm shaft bearing

$B_2 = \frac{P_r \times L_1}{m}$ = radial load in pounds on far worm shaft bearing

There is also a twisting moment:

$$P_s = \frac{P_1 \times r}{m}$$

The angular direction of this load is:

$$d = \cos^{-1}\frac{P_v}{P_r}$$

The total radial loads on each worm bearing will then be:

$\sqrt{B_1^2 + P_s^2 + 2 \times B_1 \times P_s \times \cos d}$ for the near bearing

$\sqrt{B_2^2 + P_s^2 - 2 \times B_2 \times P_s \times \cos d}$ for the far bearing

For the radial loads on the worm gear shaft bearings we have:

$B_3 = \frac{P_g \times l_1}{n}$ $\quad B_4 = \frac{P_g \times l_2}{n}$

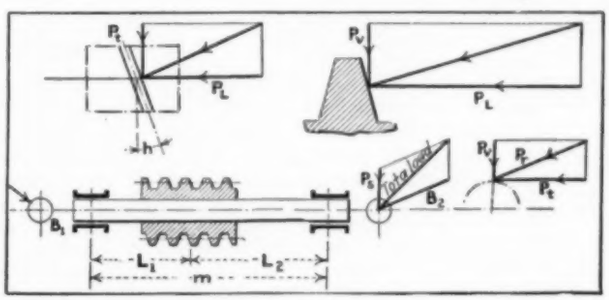
$P_{ss} = \frac{P_t \times r}{n}$ = additional load due to twisting moment

$n = \cos^{-1}\frac{P_v}{P_g}$ = angular direction of additional load

The total radial loads on each gear bearing will then be:

$\sqrt{B_3^2 + P_s^2 - 2 \times B_3 \times P_{ss} \times \cos n}$ for the near bearing

$\sqrt{B_4^2 + P_s^2 - 2 \times B_4 \times P_{ss} \times \cos n}$ for the far bearing



Submitted by S. C. Martin based on data from the Strom Bearings Company

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· TECHNICAL · ABSTRACTS ·

Preparing Shipments to Latin America

The American exporter too frequently experiences vexatious delays or costly penalties in the clearance of his goods at destination, because of failure to anticipate the exact conditions of doing business with the given country, or the lack of full information as to the procedures and regulations of foreign countries regarding the proper preparation of shipments, the handling of shipping documents, the consular requirements and practices at this end, and the conditions of entry at destination.

The United States Department of Commerce has furnished the American exporter with a sort of mariner's chart of the channels of trade with the various foreign countries, which is intended to be of practical aid in effecting delivery of goods to foreign customers with the least additional inconvenience, delay, and expense. The purpose of this mariner's chart is to set forth the successive steps in the actual shipment of goods to the countries of Latin America and the West Indies.

The first essential in the preparation of a shipment is an understanding of the requirements of the country of destination with regard to the marking or labeling of goods. Usually, the Latin American republic insists that the statement of quantity or contents on the labels of packages be given in units of the metric system. It is usually best to affix an additional label bearing an indication of the country of origin, the nature of the product, and on some goods the quality.

Most countries of Latin America have tariffs made up almost entirely of specific duties—so much per unit of weight or quantity. Again, certain Latin American countries prohibit shipments in the same package of merchandise dutiable at different rates unless the package is accompanied by a full itemization of its content. In other cases goods must be accompanied by special documents such as consular invoices and certificates of origin, and usually that these be certified by a consul of the country of destination. In shipping to the countries of Latin America, particular care must be taken to fill out all these documents in such a way as to avoid possible delays or fines upon arrival.

The point of greatest importance in making out shipping documents is a description of the goods on the consular invoice. Even a full commercial description in the current designation of the trade, which should appear on all invoices is not acceptable in all cases. Some countries require an indication of component materials; and some require declaration of goods in the actual phraseology of the tariff.

It is of vital importance to the exporter also to be familiar with the regulations of the country of destination with regard to the treatment of goods upon arrival. It is important for him to know the time allowed for presentation of documents and clearance through the customs; the provisions for effecting reconsignment of a shipment to another market, or re-exportation to the port of origin in cases where delivery at the first destination is not possible or practicable, and the regulations of each country covering storage of goods in customs warehouses, provisions for examination of goods in warehouse, and the like.—Henry Chalmers, *Commerce Reports,* April 16.

The Problem of Delegating

A great many business men are continually preaching the delegation of authority and responsibility. However, I have found that it does not work as well in my business as "do it yourself." There is one department, for instance, in which this applies very strongly, and that is costs. I have always given costs my personal attention. Our costs system is simple, and does not occupy many clerks, but it tells the costs. Attending to costs personally is of great value, because the men throughout the factory know that I am on the lookout for waste. The men know that the boss himself is going to come up personally and ask about the "whys," rather than delegate a $20-a-week clerk to do the investigating.

Similarly, I find that I can effect great economies in doing the buying myself, rather than in delegating it. I have found by experience and because I have my eyes open for any savings that can be made, that is often possible to redesign a part so that we can utilize in making it the scrap from another part, with a consequent reduction in the cost of material. The experience that I have had has convinced me that the surest way to make money and get things done quickly is to do the most important things yourself.—George W. Diener, *The Magazine of Business,* April.

Grinding Roll Turning Tools

Roll turning tools for steel mills have until recently been ground upon sandstone wheels for two reasons. First, because it was thought necessary to have a radius that would remain constant within very small limits, and, second, the workmen who ground such tools have hitherto entertained a prejudice against the so-called "emery wheels."

It has been found that the radius may be allowed to vary a great deal more than was supposed to be practicable without sacrificing the strength of the tool, making it possible to use manufactured abrasive wheels from 30 to 48 in. in diameter and using up quite a large part of the wheel before it is discarded.

The prejudice was created by workmen trying to "touch up" roll-turning tools upon any kind of wheel that happened to be available in the mill. When, as happened in nine cases out of ten, the wheel was too coarse, too hard, or otherwise unsuited to the work, the result was a ruined tool. It is true that the wheel must be adapted to the work, just as in any other grinding machine operation.

Grinding wheel manufacturers are now producing wheels of proper grit and grade for this work, and in many cases such tools are now being ground satisfactorily upon them. The grain varies in size from 24 to 46, the bond is of a medium grade, and the bonding material is usually silicate; which produces a cool-cutting wheel. No trouble whatever is encountered because of burning the steel or drawing the temper of the tool when properly selected wheels are employed.

Advantages to be derived from the use of manufactured abrasive wheels are freedom from hard and soft spots, longer life of the wheel and the certainty of duplication. It is not necessary to use water upon the wheel and work, as the tools can be ground dry with entire satisfaction.—*Abrasive Industry,* May.

Critical Temperatures in the Annealing of Brass

Annealing of brass within a temperature range where the alloy is near the border line between the alpha and the alpha plus beta field, often results in a decrease in both ultimate tensile strength and ductility. Therefore, especially when re-annealing brass is necessary, it is important that the temperatures for the two annealing operations should be either 600 to 700 deg. C. for the first operation, and 600 deg. C. for the second operation, or 700 deg. C. for both operations. These temperature ranges have no detrimental influence on the elongation.

Brass with a copper content of 64 per cent passes from the alpha to the alpha plus beta field at a temperature of 650 deg. C. (1202 deg. F.). On heating to and above this figure, beta crystals are formed along the grain boundaries of the alpha crystals, and brittleness results. No beta crystals will be found if the annealing temperature is below the transformation regions, or if the beta formed above the critical temperature changes over to alpha, which will take place if the cooling is slow.—*Fuels and Furnaces,* April.

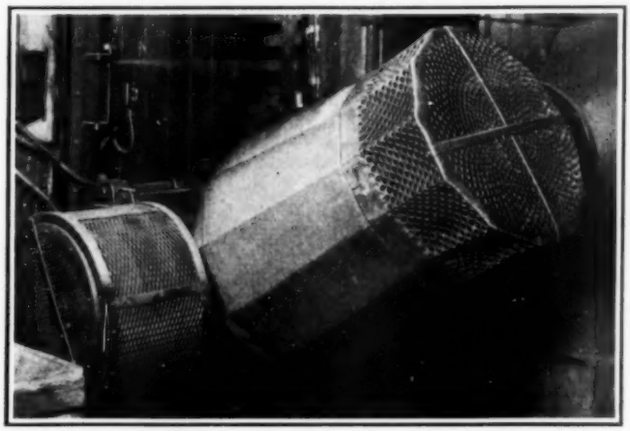
IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Sieve Hood for Tumbling Barrel

By Oliver Franklin

In order to quickly and effectively separate small parts from the polishing sawdust in a tumbling barrel, the sieve hood shown was constructed. It is in use at the Bloomfield works of the General Electric Company. After the tumbling operation has been completed, it is only necessary to tilt the barrel into its discharge position and allow



Sieve hood for tumbling barrel

the sawdust to fall upon the floor or into a suitable receptacle. The barrel is then returned to its operating position, its rotation stopped, and the hood removed so that the parts can be withdrawn. Quick-acting, but positive, latches permit easy removal of this hood.

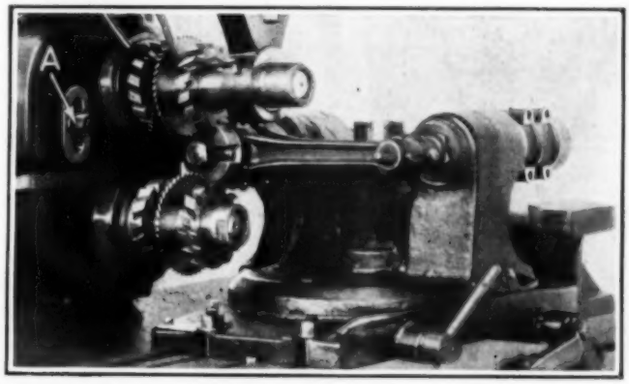
As shown in the illustration, the hood is constructed from sheet steel perforated with holes about $\frac{3}{4}$ in. in diameter. The sides are shaped to conform to the shape of the tumbling barrel, and the side piece is welded to the cover proper. Two pieces of strip steel at right angles to each other reinforce the cover against bulging.

Fixture for Milling Connecting Rods

By Frank Waldo

The fixture illustrated is used in straddle milling the bolt bosses of the large ends of connecting rods and parting off the caps. Both operations are performed simultaneously on two rods. The fixture is of the two-station indexing-type and holds two rods at each station.

While the rods at one station are being milled, the other station is being loaded or unloaded, and when the rods at the first station have been completed, the fixture is indexed to bring the rods at the second station into position. The rods are mounted on plugs that fit the



A two-station indexing fixture

holes in each end and are clamped at the large ends by bolts and C-washers.

The machine is equipped with an auxiliary spindle below the regular one and each spindle carries a saw and a pair of straddle mills. Wear of the cutters is compensated for by adjusting the lower spindle by loosening two clamping screws, one of which can be seen at *A*, and raising the housing carrying the spindle. After such adjustment has been made, it is necessary to raise the table of the machine to bring the locating studs of the fixture to a central position in relation to the spindles.

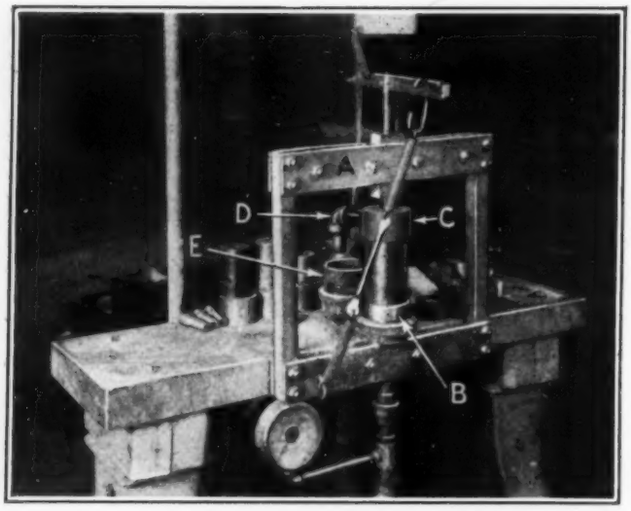
The production is 60 rods per hr. Soluble oil is used as a lubricant and coolant.

A Device for Quenching Dies Internally

By Milton Wright

Heading dies, drawing dies and similar tools that have an opening clear through them must be hard at the center, but it is a distinct advantage if the desired hardening can be accomplished without also hardening the outside. The comparatively soft outer shell tends to prevent breakage and thus increases the useful life of the tool. In the hardening room of the Hartford Machine Screw Company, the device shown in the accompanying illustration was constructed to bring about this effect.

To a bench made by bolting a single section of hardwood plank to a pair of cast-iron bench legs, is fastened the frame *A*, built up of square and rectangular pieces of cold-rolled steel. Secured to the bottom of the frame is a cup *B*, to which is attached a pipe to deliver cold water through its center. A similar cup *C*—inverted—is attached to a plunger that has a vertical movement of limited range, manipulated by the hand lever at the top of the frame and supported by a suitable guide block



Device for quenching dies from the inside

clamped between the bars that form the upper member of the frame.

A pipe nipple and an elbow are screwed into the upper cup at *D* to provide an overflow for water that is admitted through the permanent pipe below the bench. A drain pipe *E* catches the overflow and conducts it to waste. Several cups of different sizes are provided for both top and bottom connections to accommodate a range of die sizes. They are attached by merely screwing them on the threaded ends of pipe and plunger.

Water is admitted through a plug cock with a lever handle placed convenient to the operator and the flow can be regulated very nicely by watching the pointer of the pressure gage. The outfit is located beside a gas furnace in which the dies are heated.

Having raised a die-block to hardening temperature in the furnace, the operator sets it into the lower cup, pulls the upper cup into contact with it by means of the lever at the top and at the same time turns on the water. Asbestos washers in both cups prevent undue leakage at the ends while the water passes up through the hollow die and escapes through the overflow at the rear. The gage tells the operator whether or not a sufficient amount of water is flowing; a point soon determined by experience in handling a large number of dies of different sizes.

The coil spring to be seen attached to the lever is a convenience rather than a necessity. To harden small dies the operator holds down the lever with his left hand while with his right he manipulates the valve to admit the right quantity of water. On larger dies, when the flow must be continued for a longer time in order thoroughly to cool the die, the operator hooks on the spring while he attends to other duties at the furnace.

As soon as the outside of the die is black, it can be immersed in the regular quenching tank to complete the cooling.

Making Drawings on Tracing Cloth

By J. E. Fenno

In many drawing rooms the old practice of making pencil drawings on detail paper and tracing them afterward, is still adhered to.

The advanced practice, however, is to make the pencil drawings directly on the tracing cloth and then to ink them in with the exception of the lettering, dimensions, arrow heads and other free-hand work. The tacks are then removed and the drawing can be moved into such positions as will eliminate all reaching and cramping on the part of the draftsman while he is doing the free-hand work.

It has been found that by this method the work can be done quickly and neatly and with less fatigue to the draftsman. Another advantage is that there is no necessity for shifting the tracing cloth over the drawing, due to atmospheric changes, as in the case of the older method.

Developing a 60-Degree Angle—Discussion

By Henry Simon
Jena, Germany

Referring to the article under the above title by Harry Summerfield on page 745, Vol. 67, of the *American Machinist*, and the discussion of the article in question by Matthew Harris on page 984 of the same volume, the writer wishes to offer some remarks.

For generating a 60-deg. master for examining screw threads by the projection method, it would seem that the way proposed by Mr. Harris would be amply accurate, and there is no doubt that it is much more rapid. Though it is very difficult to obtain a precision 60-deg. angle

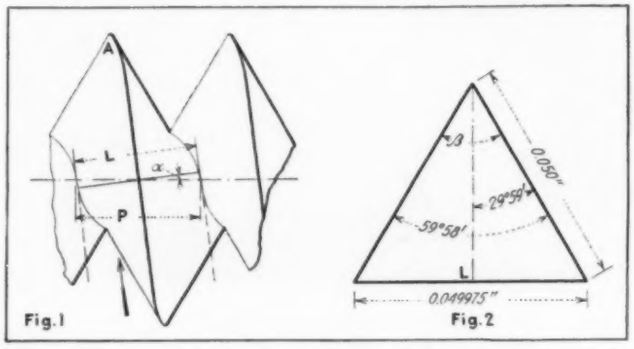


Fig. 1—Distortion of thread angle in projection when viewed in direction of helix. Fig. 2—Demonstration of angular error

by such a method, the question is of what use a nearer approximation to the 60-deg. angle would be for the aim in view. In the first place, while the projection method of examining screw threads admits of considerable accuracy and has always appealed to the writer as the only logical way because it checks every element of a thread simultaneously, it is hardly possible, by projection upon a screen, to obtain what would be called precision, such as is the evident intention of Mr. Summerfield by his

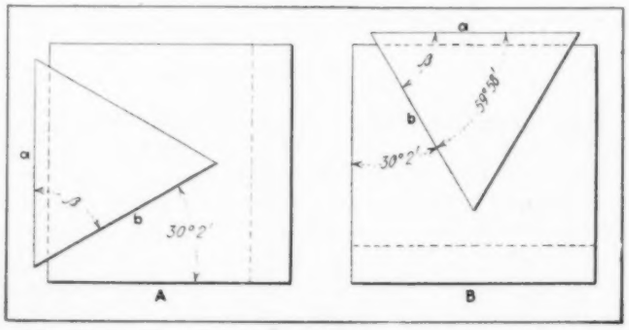


Fig. 3—Method of grinding 60-deg. gage to compensate for projection error in thread

process. If, however, it were possible to make the projection with so high a degree of precision, then a 60-deg. angle would not be required, because the exact form of a 60-deg. thread in projection is never that of a true 60-deg. angle.

Even if viewed in the direction of the helix where the lesser error in projection occurs, there is a deviation which, though small, would still be appreciable from a precision point of view for almost any ordinary thread. The manner in which the thread outline is distorted is seen in Fig. 1. Without regard to possible optical considerations, the length of the base of the thread triangle as viewed will be:

$$L = P \cos \alpha$$

For a ½x20 screw, therefore, we have:

$$L = 0.050 \times \cos 1°49' = 0.049975 \text{ in.}$$

In Fig. 2,

$$\text{Sin } \tfrac{1}{2}\beta = \frac{0.0249875}{0.050} = 29°59'$$

or

$$\beta = 59°58' \text{ instead of } 60°$$

This, of course, is a very small difference. Yet in a 4-in. master as proposed by Mr. Summerfield, the difference in the length of the base corresponding to this difference of 2′ is 0.002 in. By using the method proposed by Mr. Harris, it should not be difficult to get within 0.001 in. of the true height difference in setting the triangle with the sine bar in conjunction with an accurate angle plate, so that in so far as the thread profile is concerned, greater accuracy could be obtained in this way. By setting the triangle, Fig. 3, with side *b* at an angle of 30°2′ as at *A*, and then turning the block over as at *B* and grinding side *a*, the resultant angle β will be close to the 59°58′ required for a ½x20 thread.

A ½x20 thread has by no means a steep helix angle, and the error referred to is appreciably greater for coarser threads. It is also still greater for any thread when projection is made at right angles to the axis of the screw instead of in the direction of the helix, so that in that case the gage produced by the sine-bar method will be certain to be preferable. On threads of very steep helix angle, as for instance on very coarse or multiple threads, the use of the 60-deg. gage is bound to result in serious error.

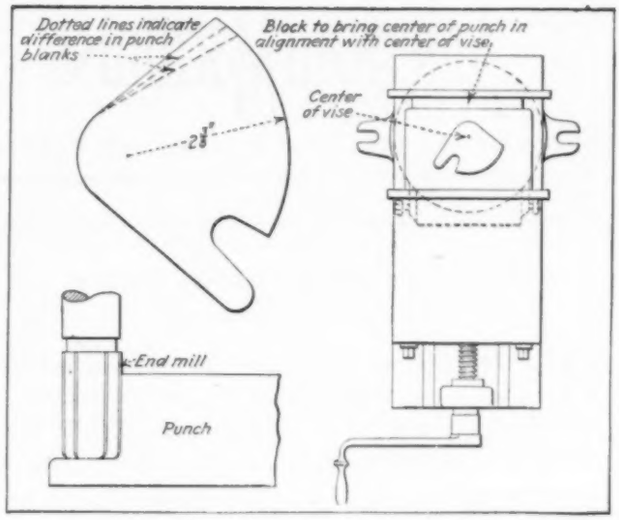
While the method described of producing an equilateral triangle seems somewhat out of place for the end in view, there can be no question that it is an excellent way of producing a true 60-deg. angle when one is needed. In this respect it is ahead of anything possible by the sine method. It admits of precision and is self-checking and independent of measurements or calculation, whereas by the sine-bar method little more than ordinary accuracy can be obtained, unless an exceedingly laborious procedure were followed.

Using a Machine Vise as a Rotary Table

By Walter W. Yaeger

In making some blanking punches I realized that a rotary table would be a great help in rough milling the punches to shape. After shearing one of the punches in the die I was able to establish the centers of the curves and decided to try using the swivel vise belonging to the milling machine as a rotary table.

It took some preparatory work to establish the center of rotation of the vise, but, once established, considerable time was saved as the radii on all the punches were similar and but little extra work was necessary after the first set-up.


Dotted lines indicate difference in punch blanks
Block to bring center of punch in alignment with center of vise
Center of vise
End mill
Punch

Machine vise used as a rotary table

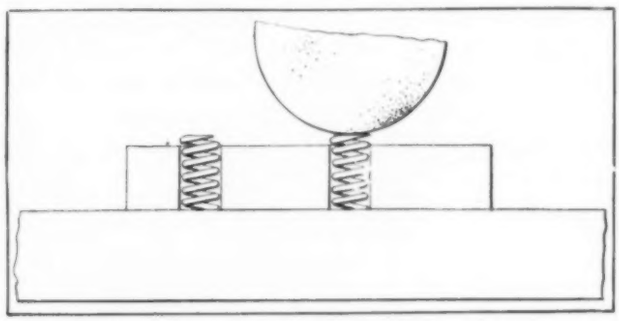
With an end mill rounded at the end to form the fillets where the punches joined their flanges, I was able to do a job that required but little filing to finish. It goes without saying, however, that no heavy cuts were taken, because I used the regular vise wrench as a lever to rotate the work. It was, of course, necessary to block the work out from the stationary jaw of the vise to bring the centers of radii of the work in alignment with the center of rotation of the vise.

Grinding the Ends of Helical Springs

By Charles Kugler

Recently I had to make some short helical springs. All were to be flat on both ends and of the same length. After trying to grind them by holding them against the side of an abrasive wheel and spoiling many springs, I hit on the following method:

I drilled some holes of the same size as the outer diameter of the springs in a piece of machine steel some-



Fixture for grinding the ends of springs

what less in thickness than the lengths of the springs. The steel piece was put on the magnetic chuck in a surface grinder and the springs were pushed into the holes, bottoming on the surface of the chuck.

With the current turned on, the springs were held in place while the projecting ends were ground. Reversing the springs in the holes, the other ends were ground flat, bringing the springs all to the same length.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Is Metal Cutting Practice Facing Another Revolution?

REPORTS come from Germany of a new material for cutting tools that far surpasses the best high speed steel for many uses. While this material is not yet available in this country, either it or its equivalent is sure to appear and it behooves forward looking designers and managers to consider its effect on machine tools of the future.

The advent of high speed steels necessitated many changes in machine tool design. Heavier beds, larger spindles of alloy steel, heat treated gears, heavier feed mechanisms and larger motors were some of the results.

Still higher cutting speeds demand harder material in the cutting tool, which in turn implies brittleness and the necessity for more rigid support of the cutting tool. This means not only a good support for the shank, behind or below the cutting edge, but also the elimination of vibration in those parts of the machine that support the tool blocks and the tool slides.

Not all kinds of work can use the new cutting materials to advantage, even after it appears. There are still many uses for carbon steel in spite of the widespread adoption of high-speed steels. Probably, only the high-production machines will be materially affected, but those who build machines of this class may well begin to ask themselves what changes may be necessary.

And it may not be out of place to remind the builders of these machines that, as the users of the new and improved designs that are bound to appear will reap the benefits. the full cost of the changes must be passed on to them.

Accuracy

ACCURACY is a word to conjure with and it frequently deceives the user more than it does anyone else. There is no question as to the growing production of more accurate machines and tools. Greater accuracy is being demanded and secured. But demands are frequently made that not only are out of reason but become ridiculous when the details are analyzed.

A glaring example was recently discovered in a gear cutting job. The cutter was ordered with tolerances of less than a half thousandth. The gears were not satisfactory and of course the cutter was blamed. Examination, however, showed that both the work mandrel and cutter arbor were out several thousandths and that the cutter was not responsible for the trouble.

It's a good plan to know that all the vital parts of a machine are right before blaming any one item for failure.

A Tragic Boomerang

TO MOST people the recent dispute over the amount of unemployment in the United States has been either amusing or disgusting, depending on the point of view of the individual. But to the few who have been caught in the machinery it has been little short of tragic.

We like to think only of the progressive employer who has discovered that it is not only unfair but bad business to take advantage of labor when times are dull, forgetting the reactionary employers who congratulate themselves on getting a six-dollar man for four dollars because of his fear of unemployment. Unfortunately, that type of employer still exists and he has made the most of the apprehension aroused in workers' homes by the wild talk of extensive unemployment indulged in by certain politicians.

The situation has its ironic aspect, too. Here we have the professed friends and champions of the workingman doing their level best to make it hard for him to get a job at good money. Of course, they did not intend any such outcome. What they were after was to discredit the administration and the party in power, but their boomerang has missed its mark and hit the very man they claim to want to help.

Standard Tapers

ATTENTION is called in another column to the work being done by committees of the A.S.M.E., the S.A.E. and the N.M.T.B.A. regarding the adoption of a standard taper, or tapers should it be decided that more than one is necessary Those who are interested may like to read the ideas of over 50 users of tapers back in 1922. These will be found on pages 551, 595 and 627 of Vol. 56 of the *American Machinist*.

It is not enough to say that the present tapers are good enough or that we should adopt either of them. Jarno tapers are in use and so is the taper of ¾ in. per foot.

· SHOP · EQUIPMENT · NEWS ·

Baird Horizontal Multiple-Spindle Chucking Machine

A HORIZONTAL multiple-spindle chucking machine of the work-rotating type designed to bore, turn and face individual pieces not over 7 in. in diameter, which can be held in chucks, has been brought out by the Baird Machine Company, Bridgeport, Conn. It has six spindles carried in a cylinder that locks in a corresponding number of positions, and a six-sided turret to which stationary tools or special devices having auxiliary movement may be secured. The turret does not index, but is moved horizontally to and from the chucks by a drum cam.

A front view of the machine is shown in Fig. 1. As may be seen in this illustration, all of the mechanism is inclosed in the main housing where it is fully protected from dirt and chips, and may be continuously oiled by the flood system. The loading station is on this side of the machine, and all controls are conveniently placed within reach of the operator from this position. All controls, however, are duplicated on the other side, and the machine can be handled with equal facility from the rear.

Front and rear slides, for parting, forming and similar operations, are located before the third and fourth spindles, respectively, and are operated by cams and levers within the housings in which they are contained. The main camshaft extends through this housing and also through the column by which the outboard end of the turret is supported, so that a drum or face cam may be placed on the exposed end to operate fixtures having auxiliary motion independent of the turret.

By removing a large cover as shown in the rear view Fig. 2, the cam drum is exposed and is readily accessible for changing the strip cams by which the different rates of feed are secured. Change gears provide suitable speed changes of the cycle mechanism. The space below the turret in the base is a reservoir for cutting oil or compound, which is delivered to the tools by a pump. A perforated, hinged cover over the reservoir retains the chips at a level that renders them easy to be taken out, while the oil drains through them into the reservoir.

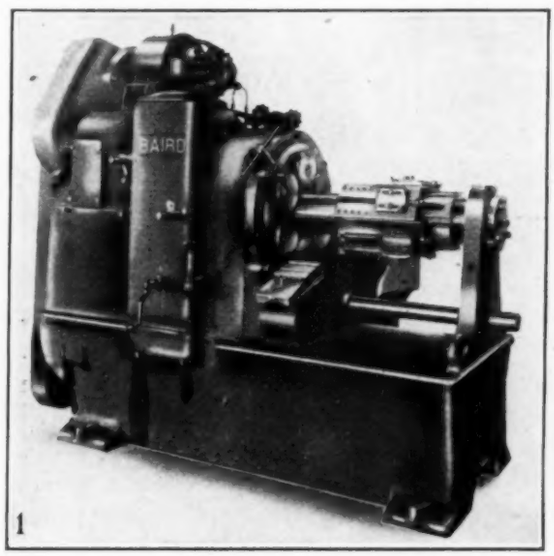
The machine is entirely self-contained, being driven by an electric motor mounted above the main housing. The drive is through well guarded silent chains. A hand crank is provided to rotate the mechanism slowly while setting tools. The machine occupies a floor space of 54x92 in. and weighs about 16,000 pounds.

Hobart "HB Constant Arc" Portable Electric Welders

Compact, unit-type construction is offered in these portable electric welders manufactured by the Hobart Brothers Company, Troy, Ohio. The welders are made in two sizes, known as HB No. 45 and HB No. 46. The capacities of these machines are 10 and 15 hp. respectively. The No. 45 machine is illustrated.

The motor and generator are built together as a single unit. The motor can be furnished for 2- or 3-phase operation on either standard or odd voltages and cycles. The generator is of the constant-potential, single-commutator type, and is ball bearing equipped. It is self-exciting. The diverter-type winding performs the combined functions of voltage regulator and inter-pole winding to produce sparkless commutation. The current of 175 amperes on the smaller machine or 300 amperes on the larger machine can be controlled by a series resistance in addition to that obtained by the voltage regulator.

Metallic electrodes from $\frac{1}{16}$ to $\frac{1}{4}$ in.



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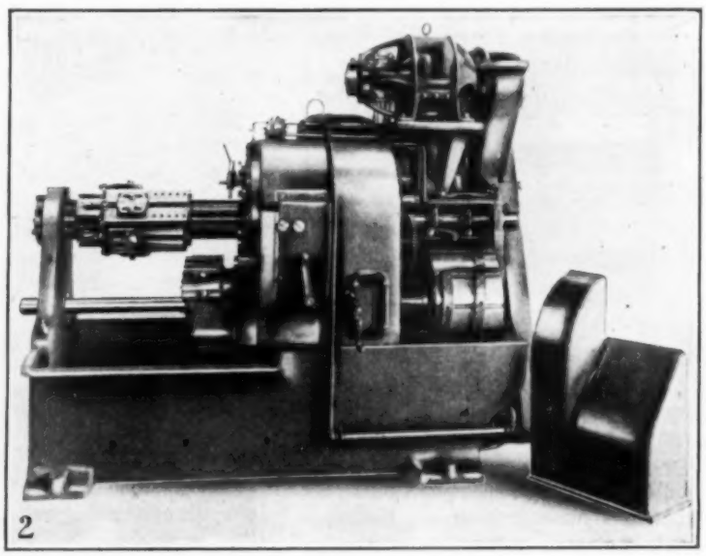
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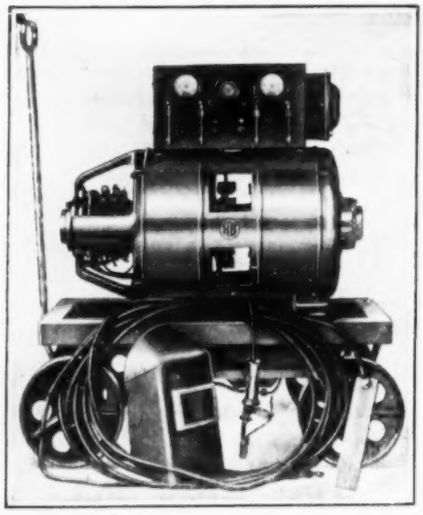
Fig. 1—Baird Horizontal Multiple-Spindle Chucking Machine. Fig. 2—Rear view of the machine with cover removed to show the main cam drum

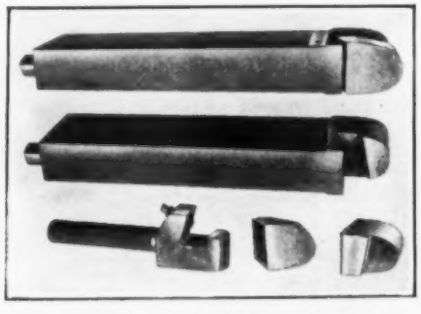


Hobart HB No. 45 Portable Electric Welder

can be used on the smaller machine, while the larger makes use of electrodes from $\frac{1}{4}$ to $\frac{1}{2}$ in. Carbon electrodes can be used on the No. 45 outfit up to $\frac{3}{8}$ in. in diameter and to $\frac{1}{4}$ in. in diameter on the No. 46 machine. The weights of the two machines are 1,075 and 1,225 lb. respectively.

O. K. Shankless Tool Bits and Holders

For turning locomotive tires and similar heavy work, the O. K. Tool Company, Shelton, Conn., has developed a tool holder and bit that does away with the customary round shank. Several advantages are claimed by the makers for this type of tool,



O. K. Shankless Tool Bits and Holders

among them being that the holder is stronger because of the absence of the through hole necessary to hold the shank type of bit, that the bit is less expensive since it contains less material, and that as the cutting edge recedes by continued wear and regrinding, the lost clearance can be restored by setting in the lock bolt, thus crowding the bit sidewise in the direction of the cut.

The shape of the bit and holder are clearly shown in the illustration. A shallow, tapered dovetailed groove in the holder receives a correspondingly dovetailed tang on the bit. The tools are made in various sizes and also in right- and left-hand types for turning in either direction. The tapers of the tang and groove always lie in the proper direction to wedge the bit more firmly in the holder under pressure of the cut.

The small holder with the knurled handle, also shown in the illustration, was produced to hold the bits while grinding them. It is so made as to hold bits with either right- or left-hand tangs with equal facility. The bits are forged from high-speed steel while the holders are made of nickel-chrome steel, heat-treated.

Davenport Modified Automatic Screw Machine

MODIFICATION of its automatic screw machine to handle other types of work has been announced by the Davenport Machine Tool Company, 167 Ames St., Rochester, N. Y. Fig. 1 shows the machine equipped to drill holes in the male part of an automobile hinge shown in Fig. 2. The tool mechanism is reversed from that in the regular screw machine since the tools all revolve while the work is held stationary.

The hinge is placed in a fixture in the usual position occupied by the work spindle, and is clamped by one of the five handles shown at the left of the machine. The pin hole in the hinge is drilled by rotating drills on the right-hand end, the first drill being guided by a bushing close to the work and drilling about one-third of the depth. In the succeeding operations, the drills in the other positions drill the remainder of the pin hole, and the hole is reamed in the last position.

During these operations, the drill spindles mounted on cross-slides drill the holes for fastening the hinge to the car body, one set of drills going part of the depth, the second set finishing the entire depth, and the third set tapping the holes. These holes for fastening the hinge to the car body are only 1 in. apart, but the drill spindles are arranged so that the driving gears are of a fair size, and each spindle has an independent lengthwise adjustment for the length of the drill.

This method of drilling all the

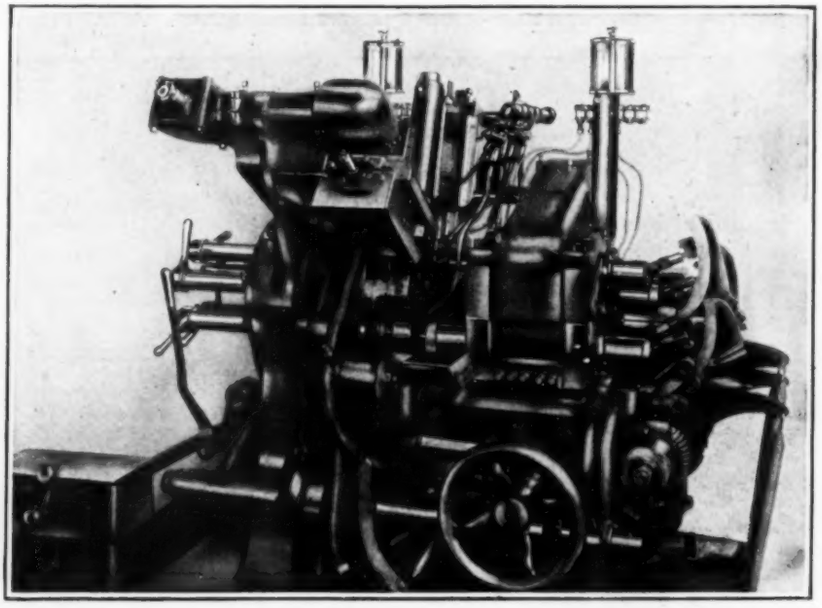


Fig. 1—Davenport Modified Automatic Screw Machine showing the tools mounted around the work

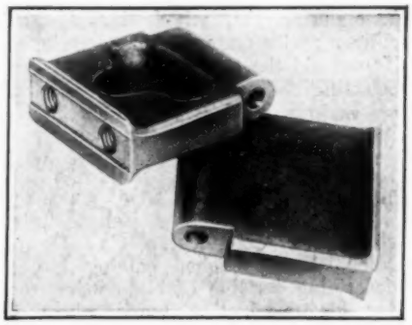


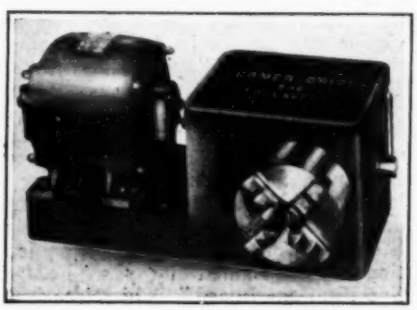
Fig. 2—Male part of an automobile hinge showing the holes drilled and tapped on the Davenport Modified Automatic Screw Machine

holes at one time eliminates any errors which might occur by doing the work in several successive fixtures or machines. The longest hole drilled is $1\frac{3}{8}$ in., and the hinges are drilled and tapped at the rate of 260 to 400 and over per hour, depending upon the carbon content of the material and the ability of the operator. A considerable reduction in the total time in a cycle is made possible by the principle used on this machine of dividing long operations into two or more short ones. In addition, each tool has an independent feed which may be adjusted for the operation involved. Of course, the machine is not confined to the part illustrated, but is readily adapted to a large variety of work.

Greaves Reamer Drivers

Large reamers may be driven by power by the reamer driver illustrated which has been introduced by the Greaves Machine Tool Company, Cincinnati, Ohio. The reamer is held by means of the four-jaw universal chuck which permits holding it by the square end.

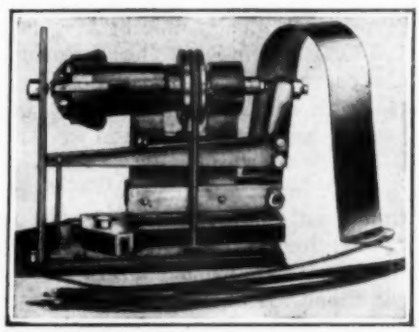
In operation, the work is held in both hands, and the reamer started at either 30 or 60 r.p.m. by pressing a foot-operated switch. After the hole has been reamed and the piece removed, the machine is stopped by releasing the pressure on the foot switch. Speed reduction is obtained through spur and worm-gearing. The two speed changes are made by shifting the lever on the side of the head while the tool is in operation. The thrust from the motor is taken by ball bearings. All other shafts are bronze-bushed. All gears run in oil and the bearings are lubricated by splash from the gears. In addition to the two-speed machine, a single-speed type is also offered.



Greaves Reamer Driver having two speeds

Mahan Centrifugal Wire Stripper

Insulation may be stripped from wire of all sizes without cutting into the strand, by means of a centrifugal wire stripper which has been developed by C. B. Mahan, 162 Longview Terrace, Rochester, N. Y. The machine shown is of the high-speed type and it is claimed to give a production of 2,500 ends per hour.



Mahan Centrifugal Wire Stripper

The centrifugal action closes the jaws of the machine to the gage which has been set for each individual size of wire. The jaws close under a definite pressure which is not sufficient to cut the wire strands. They are equipped with three small steel circular-cutting disks which may be turned slightly to present new cutting surfaces when desired. However, it is claimed that 115,000 pieces of wire have been stripped without the necessity of obtaining new cutting surfaces. The illustration shows the guard removed so that the construction of the head at the opposite end of the machine may be seen.

Carborundum Internal Grinding Wheel

Elimination of bell-mouthed holes is made possible by this internal grinding wheel that has been announced by the Carborundum Company, Niagara Falls, N. Y. This is achieved by a process that places the arbor hole in the exact center of the wheel, and which further insures concentricity of the hole and grinding surface. Furthermore, the arbor hole is finished to within minute limits of accuracy so that accurate fitting is secured. In addition to these features, it is also claimed by the manufacturers that duplication of the grit, grade, and structure is always possible. Several wheels of various shapes are shown in the illustration.

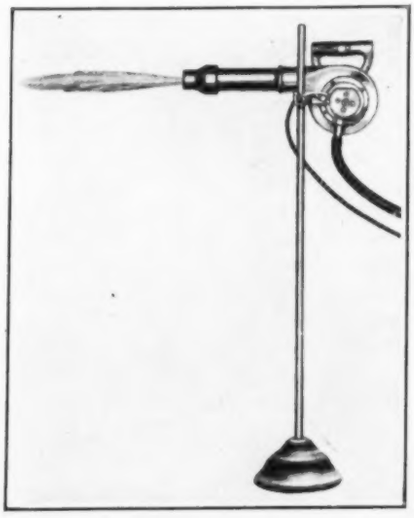
Carborundum Internal Grinding Wheels

This wheel is built for use with automatic and semi-automatic internal grinding machines. It is claimed that since the edges of the wheel hold their shape, holes can be ground which will be cylindrical to the bottom and not dished.

Clements-Cadillac Portable Blowtorch

Uniform heating temperatures up to 2,300 deg. F. can be obtained with the blowtorch illustrated, an addition to the line of blowing, suction and heating equipment marketed by the Clements Manufacturing Company, 609 Fulton St., Chicago, Ill. It is intended for use in connection with welding, brazing, annealing, local hardening and soldering operations.

The unit consists of a motor-driven torch, mounted on a stand, and equipped with an 8-ft. gas hose and a 20-ft. reinforced cable with an armored separable plug. The motor is of the high-speed, air-cooled type, mounted on ball-bearings, and can be supplied in voltages ranging from 100



Clements-Cadillac Portable Blowtorch

to 275. Variations in gas pressure do not affect the operating efficiency of the torch since the air control insures an even flow of gas regardless of the pressure in the main line. The air valve is constructed so that the air can be partially shut off, making lower temperatures possible. Heats from 1,600 to 2,300 deg. F. can be obtained quickly and maintained indefinitely.

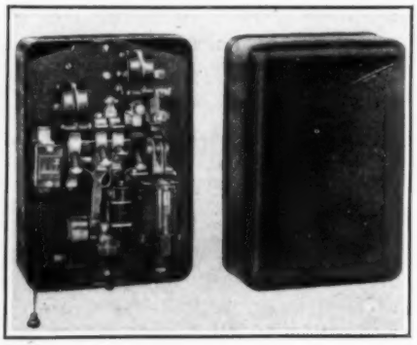
On account of the portability of the torch, it can be set up quickly at any portion of the shop having gas and electrical connections. It is claimed that the operating cost is low, made possible largely on account of the maximum desirable quantity of air used at a uniform velocity. Simplicity in construction and in operation are other features claimed for the torch.

General Electric D.C. Motor Starters

For general purpose applications a complete line of direct-current motor starters has been introduced by the General Electric Company, Schenectady, N. Y. These starters are designed to provide definite-time acceleration for constant- and adjustable-speed motors, and are divided into five types bearing the designations CR-4065, CR-4066, CR-4166, CR-4068 and CR-4168.

One of the principal advantages of the new design is the fact that, despite a reduction in size, the number of accelerating points has been increased. An improved appearance is secured by the use of drawn-shell inclosing cases shown in the illustration.

The CR-4065 starter is a constant-speed type for general purpose applications, and the CR-4066 is the same type with the addition of dynamic braking. The CR-4166 is an adjustable-speed type with dynamic braking and full-field features. The CR-4068 is a constant-speed type, reversing, with dynamic braking. The CR-4168 is an adjustable-speed type,



Typical General Electric D.C. Motor Starter

reversing, with dynamic braking and full-field features. The inclosing-case cover of these starters hooks over two pins at the top of the box, the bottom being held by a screw.

On those starters provided with dynamic braking a small relay is used to prevent the solenoid from being re-energized until the motor has come to rest. The contacts of this relay are connected in the pick-up circuit.

Thermal overload protection is provided by means of single-coil relays designed for overload protection. The relays have a thermal capacity to stand high inrush currents. These relays only operate in extreme conditions.

Trade Catalogs

AUTOMATIC LATHES. The Jones & Lamson Machine Co., Springfield, Vt., has issued a production report on the Fay automatic lathe. A description of the manner in which two machines handle the roughing and finishing operations on gears is illustrated by means of photographs and line drawings. The report contains four pages.

BOLT CUTTERS. H. K. Porter, Inc., Everett, Mass., has published a catalog containing descriptions of the products it manufactures, which includes bolt clippers, wire cutters, chain cutters, etc. Tables aid the prospective purchaser in selecting the proper tools for materials of various hardnesses. Each tool is illustrated by means of a photograph, and a line drawing is used to show the jaw capacity of each size.

SMALL TOOLS. The Eclipse Interchangeable Counterbore Co., Detroit, Mich., has published catalog No. 28 describing its line of end-cutting tools for high-production work which include counterbores, countersinks, spot facers, end form cutters, die-sinking cutters, etc. Each tool is illustrated by means of a photograph, and a table is given showing the various sizes and the range of uses. Several close-ups of the tools in actual operation are included.

Pamphlets Received

BUSINESS STATISTICS. The Department of Commerce, Bureau of the Census, has issued the "Record Book of Business Statistics," which is a background of facts from earlier years for comparison with data published monthly in the "Survey of Current Business." This paper, known as Part II, deals with metals and machinery. It may be purchased for ten cents from the U. S. Government Printing Office, Washington.

FATIGUE FAILURE. The University of Illinois, Engineering Experiment Station, has issued Bulletin 176, describing a metallographic study of the cause of fatigue failure in copper by Herbert F. Moore and Frank C. Howard. It is a study of the nature and mechanism of the progressive fracture which seems to constitute fatigue failure. Two conclusions were drawn from the tests. First, that specimens of rolled copper, subjected to repeated flexure until a fatigue crack developed, showed a surface disturbance of the metal in the vicinity of the crack. Second, the surface disturbance is shown in micrographs of unetched specimens by lines. The lines seem to develop ahead of the crack and in the direction which the crack follows as it progresses. Copies may be obtained by addressing the Engineering Experiment Station, Urbana, Illinois.

INDEX OF GOVERNMENT SPECIFICATIONS. The Department of Commerce, Bureau of Standards, has issued circular No. 319 entitled "Alphabetical Index and Numerical List of United States Government Master Specifications, Promulgated by the Federal Specifications Board." This circular is complete to January 1, 1928, and may be obtained from the U. S. Government Printing Office, Washington.

NEWS OF THE WEEK

American High-Production Machine Tools Find Ready British Market

Automotive and motor-cycle industries the largest buyers

ACCORDING to a report recently issued by U. S. Trade Commissioner William M. Park, of London, 1927 proved to be a much better year for the principal importers and distributors of American machinery, with respect to sales volume, than did 1926. One important firm in London made the statement that its business in 1927 was 50 per cent greater in 1927 than in the previous year. Another large importing house declared that business had increased beyond all expectation.

These statements are quite fully borne out by the import statistics, which show 101,639 tons of machinery of all kinds, valued at £15,901,428 imported in 1927, compared with 80,433 tons valued at £12,782,897 in 1926. In fact a fairly consistent and steady gain in imports is indicated during the past few years, as the 1926 and 1927 figures are both in excess of those for 1925 in both quantity and value.

Similarly, imports of machine tools have risen from £770,738 in 1925 to £927,293 in 1926 and £1,180,370 in 1927. It is interesting to note that the substantial increase in the value of these imports in 1927 as compared with 1926 took place despite a decline in tonnage from 7,890 to 7,678 tons during this period. In 1927 a very slight reduction occurred in the volume of machine tools imported, but the value was as large a proportionate increase over 1926 as that year showed over 1925.

The accompanying table gives the principal countries of origin for machine tool imports and the average per ton value of each. It should be noted that although the volume of imports from the United States approximates closely that from Germany, the average per-ton value is enormously greater. This fact illustrates clearly the market situation whereby American tools, because of their high quality, find a ready market in competition with tools of other nationalities, despite the fact that the latter are considerably cheaper. The average value per ton of machine tools imported from the United States during 1927 was £227, as compared with only £90 for German equipment and £131 for other countries.

A leading firm distributing American machine tools and equipment almost exclusively, states that their best sales have been in high-production tools, such as milling machines, hydraulic-feed grinding machines, crankshaft lathes, balancing machines and honers. Business in smaller American machines has been barely holding its own. Information was also furnished by this firm that American tools are being copied by British makers, and in such cases the British-made machines are being sold at much lower prices than the American—thus developing a type of competition similar to that which has been experienced from Germany.

Another principal firm handling American tools, and one whose sales have held up well, attributes its success to the fact that it no longer works through agents, but makes sales direct, and has its own demonstrator and service expert, who was trained in the American works. Whereas previously, when operating through an agent their sales volume was approximately $100,000 per annum, they have now been able to increase sales to approximately $180,000 per annum through direct selling. This firm also complains of difficulty through having their machines copied by British makers and sold at much lower prices, but thinks that this practice could be overcome through taking out patents in Great Britain. Such a procedure would necessitate manufacture in the British Isles, and not only this firm, but several other important ones, advocate having the heavy base castings made in England, thereby saving the bulk of the freight charges and complying with the British patent law requirements, in addition.

It is safe to say that the bulk of the market open to machine tools in Great Britain is, and has been, due largely to a few industries. As in the United States, the automobile industry in Great Britain is the principal consumer of machine tools and shop equipment. This will be fully understood when it is remembered that there are in the country manufacturers producing 66 makes of passenger cars, and 46 makes of trucks. In addition to these British manufacturers, several leading American, French and Italian firms have assembly plants in Great Britain in which large numbers of machine tools are employed. The total output of automotive vehicles (approximately 160,000 cars and 70,000 trucks in 1927) while extremely small in comparison with the United States output, nevertheless places Great Britain in second place as a world producer of these vehicles.

Cycle Industry Expanding

Closely allied to the automobile industry is the motor-cycle and bicycle industry, which has likewise grown rapidly during the past few years. British production of motor cycles is the greatest in the world, having averaged around 120,000 annually since 1925. Over 600,000 motor cycles and 10,000,000 bicycles are in use in the country, and the manufacturers are, of course, large consumers of machine tools. Further expansion may be expected.

In the electrical industries manufacturers of radio equipment have been more active than in other lines, and have undertaken a considerable amount of factory expansion and new building, thus offering opportunities to machine tool distributors. Shipbuilding, too, has largely recovered from the devastating effects of the 1926 industrial disputes. Manufacturers of textile machinery and railway shop equipment, however, have been only moderately active, but as conditions improve they will probably offer a better market for machine tools this year and next than was the case during the past year.

It must be recognized that the British market offers the widest field to American precision and high-production machine tools. As for the so-called "bread and butter" types of machinery and tools, there is too much competition at low prices from English makers and importers of German lines to make the market attractive to American producers. In the main, American tools are sold on a production guarantee and as high-efficiency equipment, for which purposes the necessarily high prices are not prohibitive.

As the industrial conditions of the

Imports of Machine Tools into the United Kingdom

Country of Origin	1925 Tons	1925 Value	1926 Tons	1926 Value	1927 Tons	1927 Value
Germany	2,114	£207,386	3,559	£267,253	3,510	£318,886
United States	2,091	476,837	3,760	590,200	3,275	744,440
Others	803	86,515	571	69,840	893	117,044
Total	5,008	£770,738	7,890	£927,293	7,678	£1,180,270

country continue to improve, the market for machine tools and shop equipment will undoubtedly increase. Although British and German competition may be expected to grow and offer more resistance to the sale of American products, on the whole American machine tools and small tools are holding their own in the British market and will continue to do so. In the highly specialized lines distributors are confident that the market prospects will steadily improve.

The question has arisen in some quarters as to the possibility of an import duty being levied against machine tools. Careful inquiry, however, confirms the general belief that no such duty will be imposed.

Practically all importers of American machinery and machine tools complain of the high post-war ocean freight rates, stating that these rates on American tools are about three and a half times the pre-war rates and out of line with steamship operating costs. Because of these rates some firms, which have not previously done so, are now seriously considering the manufacture of heavy base castings in Great Britain. A reduction of these rates would of course be advantageous towards increasing the British market for American machinery and tools.

Changes in Standards Committee Procedure

Extensive revision of its rules of procedure to speed industrial standardization work on a national basis, is announced by the American Engineering Standards Committee. The chief object in broadening the procedure has been to make it so flexible that it may easily fit all of the varied conditions to be met in the wide range of industrial subjects covered by the Committee's work. The revision is based upon the experience of the Standards Committee during its nine years of activity as a national standardizing body.

Three important changes are made in the procedure: Heretofore, each sectional committee (essentially a joint committee composed of representatives of the various groups interested in the particular work in hand) has acted under the administrative support and direction of one or more of the interested bodies, termed sponsors. A sectional committee may now operate autonomously, reporting directly to the A.E.S.C.; or it may act under sponsors as before. The second change recognizes "proprietary" standards and makes possible the revision of such standards within a single organization on condition that it be shown that a standard is acceptable to the groups concerned. This method is particularly applicable to highly specialized fields in which the standard of an organization has already achieved a position of recognized eminence. The third change provides for very simple cases. The approval of standards under such cases is based upon the action of a conference followed by written acceptances of the interested groups. The basic test to be applied in all cases is the fact of the assent, affirmatively expressed, of the groups having substantial interest in the standard.

The governing authority of the American Engineering Standards Committee is at present vested in 63 men representing 36 national organizations, industrial, technical and governmental. About 350 national organizations are officially co-operating in the work, with 2,100 individuals engaged on various committees. Up to the present time, 111 national standards have been approved, and 164 additional projects representing almost all branches of industry are under way.

Dean Kimball to Be Consulting Editor of Management Series

Dean Dexter S. Kimball, of Cornell University, has accepted the consulting editorship of the new "McGraw-Hill Industrial Management Series." The first volume in the series will be "Standards and Standardization," by Mr. N. F. Harriman, senior engineer-physicist, National Bureau of Standards. It will be published during the summer.

Other subjects to be covered are: "Industrial Economics," "Location, Arrangement and Construction of Industrial Plants," "Control of Production," "Transportation and Handling of Materials," "Time and Motion Study," "Industrial Accounting," "Purchasing," "Corporate Ownership," "Industrial Relations," "Safety and Accident Prevention," "Forecasting and Budgeting," "Industrial Marketing," and "Industrial Research." This series is logically arranged to cover the entire field. The manuscripts of several of the volumes are in process and will appear as they are completed, but not necessarily in the order listed.

Germany Now the Largest Exporter of Electrical Products

Germany has now become the world's foremost exporter of electrical equipment, outdistancing both the United States and Great Britain, a trade bulletin just issued by the Commerce Department reveals. During 1927, German shipments to foreign markets reached a value of $120,000,000 as compared with $102,000,000 for the United States and approximately $80,000,00 for Great Britain. The basis of Germany's advance in electrical exporting, according to the bulletin, rests on the price factor.

Germany's electrical products, the report discloses, are shipped to every part of the world, although its best customers are in Europe. In this area German manufacturers have a decided advantage because of proximity of markets. The Netherlands is Germany's largest customer for electrical lines, followed by Great Britain, Russia, Argentina, Sweden and Italy. In 1927 shipments of German electrical items to the United States were valued at about $2,000,000, about 2 per cent of the total.

Report on Migration of Industry Issued

An important contribution to knowledge on the subject of migration of industries has been made by the Chamber of Commerce of the United States in its report, "New Manufacturing Plants—1927." This report considers manufacturing plants starting operations during 1927, and is based on data from 755 cities, of which 406 reported the establishment of 1,233 primary manufacturing plants, 218 branch manufacturing plants, and 250 manufacturing plants removed from other cities—a total of 1,701 manufacturing plants.

The entire report considers the factors influencing plant location, such as: labor conditions, available power, proximity of raw materials, transportation facilities, climatic advantages, cost of site, tax rates and potentiality of surrounding market. It indicates that the furniture, hardware and chemicals industries were most mobile, and that the greatest industrial migration occurred in the Middle West, the Pacific Coast and the Middle Atlantic States.

S.A.E. Summer Meeting Plans

Tentative plans for the summer meeting of the Society of Automotive Engineers, Inc., to be held at the Chateau Frontenac, Quebec, from June 26 to 29, have just been announced by section headquarters of that organization at 29 West 39th St., New York City. The meeting will open on Tuesday, June 26 with standard and general sessions. Wednesday will be devoted to chassis, transmission production and Canadian sessions; Thursday, research, transportation, transmission and body design sessions; Friday, engine session, and Saturday a special steamer trip up the Saguenay River and sightseeing trips to Ste. Anne de Beaupre and Montmorency Falls.

World Automobile Congress to be Held in Rome

This year's World Automobile Congress is to be held in Rome, Italy, between September 25 and 28, 1928. Representatives of governments, representatives of automobile clubs throughout the world and members of the Society of Motor Manufacturers will meet to discuss such subjects as "The Use of Motor Vehicles by Governments," "Motor Fuel and Fuel Economy," "Road Im-

provement," "Co-operation Between Rail and Road Transport," and the "Means of Stimulating the Sale of Motor Vehicles." A visit to the "Autostrade" in Milan and a trip to Turin are planned.

The Congress will be held under the auspices of the Permanent International Bureau of the Society of Motor Manufacturers, of Paris. The Congress was organized by the Union of Italian Automobile Manufacturers in conjunction with the Royal Automobile Club of Italy. The president of the executive committee is Count Romeo Gallenga Stuart, 38, Via S. Maria in Via, Rome.

Engineering Foundation Seeks $7,000,000 Endowment

An endowment of $7,000,000 is sought for the Engineering Foundation and the Engineering Societies Library, it is announced by the board of trustees of the United Engineering Society, representing the national societies, of civil, mining and metallurgical, mechanical and electrical engineers. A fund of $5,000,000, it is planned, will be applied to the research projects of the Foundation, and a second fund of $2,000,000 to the maintenance of the library.

The foundation was established thirteen years ago with a gift of $500,000 from Ambrose Swasey, engineer and manufacturer of Cleveland, Ohio. This amount has been increased to about $625,000.

Secretary of Commerce Herbert Hoover, who has accepted appointment to the endowment committee, of which Col. Edward A. Simmons is chairman, will have as his associates: Roy V. Wright, Edward B. Craft, Lewis B. Stillwell, Charles F. Loweth, Harry deBerkeley Parsons, Ralph J. Reed, Thomas B. Stearns, John V. Dorr, Thomas Robins, John W. Lieb, Wynn Meredith, Henry A. Lardner, E. Wilbur Rice Jr., Calvert Townley, Edward G. Acheson, John Hays Hammond, H. Hobart Porter, William Lawrence Saunders, Elmer A. Sperry and Alfred D. Flinn.

Germany Recaptures Chile Metal-Working Market

Current reports from the United States Chamber of Commerce on industrial machinery reveal that at the close of the World War this country was supplying about 80 per cent of the metal-working machinery sold in Chile. Practically all of the large machine shops used American equipment, which apparently should have given American manufacturers an advantage over the ensuing invasion of cheap German machinery.

Despite the good reputation of American metal-working machinery, however, Germany has been steadily forcing the United States out of this market, especially on such items as lathes, planers, shapers, and slotters. German prices range from 30 to 50 per cent lower and local buyers have not been convinced that American units are sufficiently better to justify the higher prices. The largest American share of the metal-working market is in small units, such as boring and drilling machines, external and internal grinding machines and forges.

French Tariff Changes and New Competition Affect Machinery Imports

Import of tractors and agricultural machinery into France will no doubt be affected by recent revisions of the French tariff law. Where previously tractors were taxed 100 fr. per 100 kg., they are now taxed from 250 to 1,000 fr. in the smaller unit weights and from 85 to 340 fr. in the larger weight units. Similar rises have taken place in agricultural machinery. Because American goods come packed, however, a coefficient is applied to the gross weight to place such shippers on an equal footing with Continental shippers, whose goods come unpacked.

There is no end of agricultural machinery and tools coming into France from Czecho-Slovakia, Austria and Hungary, and it is more than competing in some sections with American and Canadian machinery of a like nature. What aggravates the case more is the fact that in Czecho-Slovakia, such product is made in the State Railway shops and is shipped out to compete with machinery built in private shops, thus developing a new form of competition. If the League of Nations' non-restrictive and non-contingent import and export regulations are adopted, there is nothing to prevent a contiguous government producing goods which may be shipped across the border into another country to the detriment of the latter's private enterprise.

Permanent Engineering Exhibit in Berlin

A permanent exhibition of machinery and electrical equipment has been recently opened up in Berlin, and the largest German manufacturers are participating in it. A former department store has been remodeled for the purpose of housing this exhibit, and it will furnish the largest permanent place where German engineering products can be seen and examined.

Mathematical Symbols Approved

Approval of mathematical symbols as American Standards has just completed the first step in a program of unification of the scientific and engineering symbols and abbreviations used in engineering and industry, under the auspices of the American Engineering Standards Committee. The work has been progressing since 1923, with fourteen national organizations participating. The approved mathematical symbols include those for arithmetic and algebra, elementary geometry, analytic geometry, trigonometric and hyperbolic functions, calculus, special functions, and vector analysis. Prof. E. V. Huntington of Harvard University, representing the American Mathematical Society, was chairman of the Mathematical Symbols sub-committee. This sub-committee is part of the sectional committee on scientific and engineering symbols and abbreviations, of which Dr. J. Franklin Meyer of the Bureau of Standards is chairman.

Canada to Hold Second Steel and Power Show

Provision had been made for 140 exhibitors at the second annual Steel and Power Show, to be held September 4 to 7, in the Arena of the University of Toronto. Last year there were 110 exhibits. A corporation has been formed to conduct the show, and co-operating with it are: the Canadian section of the American Welding Society; the Engineers' Mutual Benefit Fund; the Canadian Engineering Standards Association; the Industrial Accident Prevention Association; and the Montreal Chapter of the Society for Steel Treating. Campbell Bradshaw, who conducted last year's show, will again be in charge.

Machine Tool Exposition in 1929

The committee on expositions of the National Machine Tool Builders' Association has announced that it is unanimously in favor of holding another national machine tool exposition in 1929. A vote by mail by members of the association indicated that a majority was in favor of another exposition next year, the remainder wanted to wait until 1930. Answers to a questionnaire submitted to the members disclosed that a majority was of the opinion that expositions constitute a sound method of merchandising machine tools in view of the success of the Cleveland show.

Erie to Spend $26,403,227

The Erie Railroad plans to spend $26,403,227 on improvements this year. These will include thirty-five Mikado freight locomotives costing $7,000,000, one oil-electric locomotive, twenty-five steel passenger cars, three steel baggage and mail cars, five steel express cars, two steel dining cars and 1,000 heavy-duty box cars. Many locomotives in service will be equipped with labor and fuel saving devices and much rolling stock will be rebuilt and modernized. The program also calls for laying 47,000 tons of heavy steel rail.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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THOSE who have had an opportunity to observe the Mississippi River in the flood stage will recall that the current sometimes seems to be running upstream or circuitously. This apparent paradox is generally due to the deflection of the water when it strikes some obstacle that temporarily impedes its flow.

So it is with the flood of speculation that has recently overspread some of the world's markets. Occasionally it seems to reverse its direction as it encounters an obstruction and early last week we had an example of such an interruption. On Monday morning the stock market seemed to hesitate. The declines were not serious when the altitudes previously reached were considered, but the effect upon those who had bought cotton and grain was almost instantaneous. They commenced to sell and the result was three days of comparative weakness, during which there was a general reduction of speculative commitments. But by Wednesday night, or Thursday morning, the squall in the stock market had passed, and although the weakness in cotton and grain was of longer duration, these markets are recovering.

Of course there were special as well as general reasons for the decline. In stocks a temporary advance in the cost of call money and the continuance of gold exports, as well as a fear that the Federal Reserve Bank of New York would raise its discount rate, were the explanations offered for the decline.

In cotton and grain, improvement in the weather and the crop outlook were the causes assigned for the liquidation. But tighter money and better crop weather were possibilities that were quite as imminent when the markets were going up as when they were going down, and the fact that their recognition appears to have depended upon the mood of the public only serves to emphasize the psychological character of the present movement. It reflects the optimism of the world, and until there is some radical change in sentiment it is likely to continue.

No one can tell how or when this change will be brought about, but until it occurs further speculative activity seems probable.

As yet, there is not much to indicate an improvement in legitimate business as distinguished from the speculative activity. That the tendency of trade and speculation should be indefinitely in opposition is of course impossible, and an increase rather than a decrease in the distribution of consumable things would seem to be inevitable, if the farmers are able to sell their grain and cotton at or around present quotations. Therefore, much is dependent upon a maintenance of current prices for our agricultural products, and unless they decline the hope of better times after the harvest season will probably persist through the summer. Hand-to-mouth buying is, however, still the rule and orders, though frequent, are all in small sizes.

Cotton goods are somewhat higher, but they remain well below the parity of the raw material. The steel industry is quieter. The automobile production is now running ahead of last year and sales are said to be keeping pace with the output. Insofar as the facts can be obtained, they appear to indicate an increase in new building. Car loadings continue to run below last year and 1926, and most railroads report a reduction in both gross and net earnings for the month of March.

Sugar is firmer because an increase in the demand for granulated is soon expected and most of the so-called "distressed" lots that had accumulated at New York have been absorbed. Coffee is likewise steady under Brazilian control despite the hope of another large crop in 1929-30, which has been raised by abundant rains falling lately in Brazil. Rubber seems to have done its worst for the time being, although the supply will apparently exceed the consumption for a long time to come. A firmer market is now apparent, however.

Confidential interviews with business men are very conflicting. Some expect an early and pronounced improvement. Others predict comparative quietude until the presidential election is over with. This divergency of opinion will probably keep things in equipoise for the present, and, as there is no distension outside of the security markets, the commercial situation would appear to be comparatively sound except as it may be affected by any sudden or important collapse on the stock exchange.

Optimism is also dominant in Europe, and speculation is spreading there as here. Great Britain's ultimatum to Egypt beclouded the situation overseas for a time, but "the status quo ante bellum" appears to have been re-established, and the English fleet has returned to its base.

As a result of the recent elections, Poincare seems to be firmly entrenched in France, and an early adjustment of the debt due the United States is anticipated. In the meantime, Europe continues to borrow here, and a gradual absorption of our surplus credit supply is in progress. Concurrently, brokers' loans have risen to nearly $5,000,000,000. These developments mean higher interest rates in the not distant future, and, when they become effective, a slackening of speculation will probably be brought about. Until this slackening occurs comparative normalcy is indicated, but it should not lessen our commercial circumspection.

WHAT'S DOING IN INDUSTRY

APRIL on the average has been the best month this year for machine tool business as reported from many quarters, such as Chicago, Detroit, New York, Milwaukee and Cincinnati. Conditions have been spotty in Philadelphia, but for some companies April business was well above the figure of April, 1927. Buying has slowed up in New England, and is below par in the Buffalo district, but everywhere a spirit of optimism prevails.

FOR THE first time manufacturers and dealers are beginning to predict business ahead. May undoubtedly will be another good month, as the outlook is excellent in all centers. Sales resistance is lessening, it is reported from Cincinnati, and the tone of inquiries has improved in New York and New England. There has been a slight let down in inquiries in Chicago, however. Practically all machine tool builders are well supplied with orders for some time to come.

RAILROAD buying, which has been spotty, is expected to improve in the near future. Automotive production is the best in some years and is, of course, furnishing a large market for equipment. Farm machinery, including tractors, is selling well, and this activity is reflected in tool sales to manufacturers of such equipment. Contractors' and road building equipment falls within the same category. Used machines have been finding a ready market for several months.

SMALL shops are busy in Detroit and in other centers where they are handling orders farmed out from automotive plants, in particular, Ford.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

MILWAUKEE

The state of the metal-working equipment market remains practically unchanged. The run of orders is mostly for single items, with here and there a buyer appearing with somewhat larger needs. A round lot is a rarity, for the acquisition of new equipment continues to be largely a matter of meeting urgent replacement demands. Dearth of plant extension and new industrial construction continues to limit large lot business.

A bright spot in the situation is the fact that metal-working shops in the Milwaukee area are employing, on the average, more men than at the peak point of 1927, which came in April. There is a place for every skilled machinist who applies for work. Semi-skilled labor is also in demand. The customary turnover of labor of the skilled class is somewhat below the average of recent years and the wage situation is reported as very agreeable, in view of the May 1 disputes of some former years.

The expectation is for a steady business in metal-working equipment through the summer months, with no spectacular features in either direction. Most local shops are comfortably situated with respect to orders for prompt and future delivery. While there has been somewhat of a lull in the demand from automobile shops, the demand from this source is expected to pick up with the tooling up process for new models usually brought out at mid-year. Farm machinery makers are still buying equipment, the tractor industry being in a particularly healthy state.

BUFFALO

Conditions in the machine tool trade continue to be spotty. Some dealers report that April was a better month than any in the first quarter, but most say that the volume of business was less in April than in any month of the first quarter. There seems to be much business which has been pending since February. Dealers are hoping that most of it will break in May, and there are some indications that such may be the case.

Much the same sort of condition exists in the electrical equipment field, although contracts for several big grain elevators may be let. These are the only large contracts which are available at present.

There is the usual seasonable flurry of business in the contractors' equipment field, a welcome relief after the dullness of the first quarter. This will doubtless continue rather briskly and optimism concerning the summer months is apparent generally.

CHICAGO

Reports on machine tool business for April indicate that April was the best month thus far this year for many machine tool-building plants. One manufacturer, whose works are located in Wisconsin, stated that his company did more business last month than in any corresponding month since 1920. May, so far, has shown no tendency toward a let down. The demand is holding to a very good level; the increasing production in general industry being responsible for much of the business transacted. Railroad buying is negligible now, although purchases in April were in good quantity. The Allis-Chalmers Co., Milwaukee, the Nash Motors Co., of Kenosha and the J. I. Case Threshing Machine Co., Racine, have been reported as having made tentative inquiries for additional shop equipment. The market for used machine tools is steadily improving, an unusually large quantity of assorted tools having been sold this week to a local concern recently incorporated to manufacture automotive motors of a new type. As a whole, the machine-tool market may be said to be generally satisfactory.

DETROIT

The machinery and machine tool business in this city is still characterized by the same steady growth that has marked it for the past four months. The total sales for April were a little higher than in March. The average for the first third of the year is very much above the similar period of last year and ranks well with that of 1926, which was an unusually profitable year.

Business of all types is coming in. Inquiries are regular and come from all types of business. All of the small shops are busy. The automobile manufacturers are busier than they have been in months, and the associated industries are working at top speed.

Intense activity has been shown by several automotive manufacturers. Graham-Paige built three times as many cars in April as in the corresponding month of 1927. The new straight-eight model, just introduced, is going very well, and it is expected that it will serve to swell still more the output of the various plants. The Hupp Motor Car Co. shipped nearly twice as many cars in April of this year as it did in the same month of 1927, and a new high record of production was set. Hudson had an unusually good month in spite of the fact that many changes in machinery and factory layouts were made. Packard and Studebaker experienced very good business, and Dodge shipped 57 per cent more cars in April than it did a year ago during the same period. Oakland, Pontiac, Chevrolet, Cadillac and LaSalle all went over the productions figures of April, 1927, and all report many orders on hand for May.

CINCINNATI

Taking the reports of the machine tool manufacturers of the Cincinnati district as a whole and striking an average there was a slight increase in the volume of sales in the past week. Here and there a manufacturer reported a lull in the week and a few reported that they merely held their own, but the majority reported that they made at least some gain. All state that there is a large amount of business pending and the feeling is that this will be booked in the very near future.

Selling agents report that in their respective territories the market brightened up considerably in the past week. In this branch of the trade it is thought that the prospect for a larger volume of business is improving, not because there is a greater need of tools, but because sales resistance and hesitancy to buy are decreasing.

Inquiries came in freely during the week, from all sections of the country, the majority being from general machinists and miscellaneous users. There were a few small lists among the inquiries, but the greater portion of them were in regard to single tools and replacements. Inquiries from the automotive field were more numerous than in the previous week, but these were confined to single tools. A small number of purchases of single tools were made by railroads.

NEW ENGLAND

The New England machine tool market slowed up perceptibly during the early days in May. The situation, because of a scarcity of new orders, approaches dullness. There seems to be on the other hand no lack of inquiry, which in so far as the month of May is concerned, should be rated as promising. April, however, presented a similar condition, but fell below expectations according to reports from most builders.

Prospective business in this section is expected from the electrical, aeronautical, and automobile industries, with better prospects from the steel industry. The automotive industry continues to buy from all sources in this district, including not only the machinery builders but also contract shops, textile manufacturers, foundries, woodworking plants and small parts manufacturers. The accessory manufacturer in the automotive industry is expected to be a good buyer of machinery during the month.

Contractors supplies and road building equipment are in strong demand. The portland cement industry has plans for expansion at Pownal, Vt., where plans are being formulated for the construction of a plant involving an expenditure in excess of a half million dollars for machinery alone.

PHILADELPHIA

April business in some of the machinery and machine tool lines was about twenty-five per cent above the corresponding month of 1927. Dealers in abrasives reported a fairly good business with inquiries having a hopeful aspect, although others reported a lack of sufficient orders to make the situation encouraging. Reports from many sources indicate that business is still spotty, that condition having continued from two weeks ago.

The automotive industry is the high point in the situation in this market. The dealers and manufacturers are looking forward to the acquisition of additional business from the Detroit centers if the present trend in the automotive line continues. Producers of machinery for railroads say the business has not developed as rapidly as they had anticipated and inquiries are not as plentiful as they had hoped for. Some Mid-Western railroads, however, recently purchased some single tools for replacement.

NEW YORK

There is a spirit of optimism in the air in the machine tool market in the New York district that cannot be mistaken. For the first time a few dealers and some direct factory representatives are predicting what their future business might be. From all accounts May should be a good month. In some instances April business was reported to have been much better than that of March, while in others there was a slight recession, to be explained by the fact that March business had been exceptional for many. The market is spotty, however, to the extent that some dealers report a decline in orders and inquiries in the past week.

The way one representative put it: "We have a full month's business anticipated by orders promised upon release of appropria-

tions that are positively assured." From the general offices of two companies came the statement that April as a whole had been the best month this year, and that May was expected to be better, with most of the activity in the local market, according to one. From a dealer came the remark that while the last week showed a falling off in orders, the nature and tone of inquiries was such as to make the immediate future look good.

Some railroad buying is expected in the near future to break the deadlock of the past month. The Erie R.R. is in the market for a 20-in. turret lathe and a 90-in. wheel lathe, the New York, New Haven & Hartford R.R. has a list out, and it is anticipated that other Eastern roads will soon start actual buying. Along with this activity, sales of large-size equipment are expected to pick up in the near future.

Comments from factory representatives indicate that most machine tool builders are well supplied with orders. Makers of milling machines, turret lathes, toolroom lathes, grinding machines, and even of strictly railroad equipment, are doing business well above the average. In the latter case, the market is outside this territory, being concentrated in Chicago.

Small tools, including grinding wheels, continue to sell well in this territory.

The General Electric Co., mentioned as a big buyer last week, is still buying in volume, this time for two large service stations in the Middle West. All orders originate in Schenectady, however. Two jig borers were sold by the Pratt & Whitney Co. in the past week, one to an ignition manufacturer in Ohio, another to a concern in Cleveland. The same company also sold a 22-in. vertical surface grinder and a 16x36-in. lathe to an automobile manufacturer in Indiana; a 13x30-in. and a 16x60-in. lathe to an electrical manufacturer in the East; and a gear tooth grinder to a motor company in New Jersey. An automotive company in Detroit bought a 4-spindle drum-type miller and a construction company in Birmingham, a 600-lb. steam hammer, both from the Niles-Bement-Pond Company.

One importer of punch and shear equipment claims that only a few structural shops are buying machines, while a factory representative of similar domestic equipment points to considerable activity in that line. Another importer (of gear cutting machines) finds a decrease in orders in the past month and a falling off of inquiries, and mentioned that one-third of another line, that of precision measuring instruments, was being absorbed by a single automobile company—Ford.

Taylor Society Discusses Time Study

In co-operation with the Society of Industrial Engineers and the Society of Time Study Engineers, the Taylor Society held a two-day meeting on time study in Detroit on May 7 and 8. Morris Llewellyn Cooke, president of the Taylor Society, presided at the first session at which Dwight V. Merrick, of New York, presented "Major Characteristics of the Taylor Technique of Time Study." The discussion was led by W. O. Lichtner, of the Thompson & Lichtner, Inc., and L. K. Fyler, of Eaton, Crane & Pike Co. Papers presented at later sessions that day included: "Study of Fundamental Operations of a Machine vs. Study of Individual Operations," by G. E. Schulz, Armstrong Cork Co.; "Unit Times vs. Overall Times," by Earl Watson, Pontiac Motor Car Co.; "The Relation of Time Study and Motion Study," by Lillian M. Gilbreth; and "Standardization of Conditions and Analysis of Operations," by G. J. Stegemerton, Westinghouse Electric & Manufacturing Company.

Further subjects discussed on Tuesday included: "Analysis of Data and Computation of Net Time," by George DeGraw, Dodge Brothers, Inc.; "Computation of Allowances," by Stephen B. Sponder, Chicago Flexible Shaft Co.; and "Production Study as a Check," by L. W. Haskell, Dodge Brothers, Inc. Mr. Haskell also spoke on the subject of "The Application of Time Study to Shop Operations" at the evening session held jointly with the store managers division of the National Retail Dry Goods Association. Inspection trips included visits to the shops of the Cadillac, Dodge, Hudson, Packard, and Ford motor companies.

Increase in Small Marine Engine Production

One of the most interesting developments in the automotive field in the Detroit district is the advancement of the motor boat industry. This business as well as the business of manufacturing marine engines of all types has taken very big strides within the past year and bids fair to become one of the important minor industries. As an example of the progress that is being made the Chris Smith and Sons Boat Co., makers of the "Chris-Craft," produced more than 200 boats ranging in price from $2,000 to almost $10,000. The Dodge "Watercar" is also making substantial advances as are the products of a number of smaller concerns in this district.

Die Stock Standards Become Effective

The Department of Commerce announces that the proposed revision of Simplified Practice Recommendation No. 57, relating to chasers for self-opening and adjustable dieheads, has been accepted by a sufficient number of users, producers and distributors to insure its general adoption. The standard is therefore to be considered effective from April 1, 1928. New booklets containing the changes will be available shortly.

John Deere Tractor Plant to Be Expanded

Expansions of the John Deere tractor plant in Waterloo, Iowa, involving expenditures of several millions upon new plant and equipment have been announced by Deere & Co. Allen H. Head, vice-president and general manager of the Waterloo plant, states that the program will require two years to fulfill. The present working force will be doubled and the Waterloo plant is expected to become the largest factory in the United States devoted exclusively to the manufacture of tractors. In addition to the three-plow tractor which has been made at the Waterloo unit, a new smaller general-purpose tractor is being introduced with scheduled quantity production to begin about July 1. This year 3,200 carloads of raw material, estimated to weigh about 110,000 tons, will go into the production of the tractors.

Wright Expansion

The erection of a new plant and the expansion of existing facilities at an expenditure of about $3,500,000 are planned by the Wright Aeronautical Corporation, of Paterson, N. J. Output will be increased to 180 engines per month to take care of the volume of orders on hand. The construction of the new buildings will take care of normal increases in business for the next three years, it is stated.

W. T. Emmes Dies

W. T. Emmes, vice-president of the Boye & Emmes Machine Tool Co., of Cincinnati, died on May 2, at the age of 65, after a long illness. Mr. Emmes came to Cincinnati 35 years ago, when he entered the employ of the R. K. LeBlond Machine Tool Co. Later he became superintendent of Schumacher & Boye, which became Boye & Emmes in 1912 upon the retirement of Mr. Schumaker. Mr. Emmes was a well-known figure in machine tool circles, especially in Cincinnati, where he had many friends and associates. He leaves fourteen children.

Business Items

Consoer, Older & Quinlan, Inc., consulting engineers, are now located in the Engineering Building, 205 W. Wacker Drive, Chicago.

Joseph T. Ryerson & Son, Inc., Jersey City, N. J., has been appointed representative in the New York district of the Dreses Machine Tool Co. of Cincinnati.

The Ingersoll-Rand Drill Co., 314 N. Broadway, St. Louis, Mo., will be succeeded by Ingersoll-Rand, Inc. A new branch operating under the St. Louis office will be opened at 226 West A St., Picher, Okla.

A new Caminez engine manufacturing plant has been put into operation by the Fairchild Caminez Engine Corporation. It is expected that the present production of three engines a week will be increased to ten by July. The plant is at Farmingdale, Long Island.

The Fort Worth Well Machinery & Supply Co., Fort Worth, Tex., manufacturers of oil well equipment, has acquired control of the Texas Manufacturing Co., also of that city, and the equipment of the Fort Worth Drilling Tool Co., it has been announced by A. H. Hardman, president of the first-named company.

The Hydraulic Pressed Steel Co., Cleveland, Ohio, has been purchased by the Truscon Steel Co., of Youngstown, Ohio, and will be operated as their pressed steel division. The entire plant is being completely modernized to insure the most efficient production. The improvements are proceeding rapidly, and full productive capacity will be available shortly.

Expansion of the production capacity of the Mechanics Machine Co., Rockford, Ill., was predicted upon report of its inclusion in the merger of the Borg & Beck and Marvel Carburetor companies of Chicago, manu-

facturers of automobile transmission and clutches. The Rockford plant now employs 1,200. Erick S. Ekstrom is president and Levin Faust, secretary-treasurer of the company.

The General Electric Co., which recently bought control of Metropolitan Vickers, Ltd., one of the leading British electrical manufacturers, has transfered these holdings to Dudley Docker, of London, a financier who seeks to unite the British electrical industry into a single, powerful unit. The British Thomson-Houston Co., another General Electric subsidiary, also plans to participate heavily in the government-sponsored movement to establish a national electrical system.

The LeBlond Aircraft Engine Corporation has applied for a charter at Columbus for the manufacture of radial air-cooled engines for airplanes at the LeBlond Machine Tool Co. plant. The incorporators are Richard K. LeBlond, Henry G. Pierle and Glenn D. Angle. The corporation will be a subsidiary of the LeBlond Machine Tool Co. and manufacturing will be in charge of Mr. Angle, owner of the engine patent. Engines of three types will be produced, a three-cylinder developing 45 hp., a five-cylinder developing 60 hp. and a seven-cylinder developing 90 horsepower.

The Milton Manufacturing Co., Milton, Pa., manufacturer of iron bars, bolts, nuts, rivets, etc., which was recently discharged from receivership, has been reorganized with a new board of directors and the following officers have been elected by the board: W. W. Wilson, president; R. W. Krise, vice-president; Harry W. Chamberlin, secretary; O. S. Stamm, treasurer. Mr. Wilson, the new president, was one of the receivers of the company. The following executive committee was also named: Mr. Wilson, Mr. Chamberlin, N. Thompson Marsh, James B. Graham and Seth T. McCormick, Jr.

Personals

ALFRED E. MUNCH, JR., has been appointed representative in the Chicago-Milwaukee district of the Rollway Bearing Co., Inc. His headquarters will be at 544 Railway Exchange Bldg., Chicago.

RAYMOND W. COOK, factory manager of the Wallace Barnes Co., of Bristol, Conn., delivered a talk, on May 8, on "The Manufacture of Springs" before the Hartford Chapter of the American Society for Steel Treating.

RICHARD I. NEITHERCUT, secretary of the Bridgeport Brass Co., Bridgeport, Conn., has severed his connections with that company to be vice-president of Industrial Administration, Inc., 551 Fifth Ave., New York.

JOHN S. OURSLER, general superintendent of the Homestead Works of the Carnegie Steel Co., has been elected vice-president of the company to succeed I. Lamont Hughes, who was elected a vice-president of the United States Steel Corporation.

R. W. WALES has been appointed factory representative on molding powders and resins by the Celoron Co., division of the Diamond State Fibre Co., of Bridgeport, Conn. This company recently introduced its compounds to the electrical, radio and automotive trades.

FRANK B. HOFFSTETTER, who has been associated with the Seifreat-Elstad Machinery Co., of Cincinnati, and who was formerly assistant superintendent of the R. K. LeBlond Machine Tool Co., has accepted a position as factory manager of the C. H. Quackenbush Co., of Cleveland, Ohio.

ELMER A. SPERRY has been elected president of the board of the Guggenheim Medal Fund, handling awards for notable achievements in aviation. E. P. Warner, assistant secretary of the Navy in charge of aeronautics, is vice-president, and Alfred D. Flynn, director of the United Engineering Societies, secretary and treasurer.

GEORGE A. UHLMEYER, industrial engineer for the People's Power Company, Moline, Ill., was elected chairman of the Tri-City chapter of the American Society for Steel Treating. R. E. McGee, metallurgist, International Harvester Co., Rock Island, was elected vice-president and Ernest E. Mueller, Carpenter Steel Co., secretary-treasurer.

HENRY P. BLOW, for many years production manager of the Pontiac division of the Fisher Body Corporation, has been made general manager of the division succeeding R. E. Brown. Before coming to Pontiac, Mr. Blow was production manager of the Flint division of the Fisher Body Corporation. George Folsom has been named production manager in Mr. Blow's place.

C. O. MINIGER, president of the Electric Auto-Lite Co., of Toledo, and of the U.S.L. Battery Corporation, of Niagara Falls, N. Y., has been made a director of the Auto Equipment Co., of Monroe, Mich. This company, makers of hydraulic shock eliminators and the Monroe line of automobile heaters and self-oiling tire pumps has experienced a very large increase in business within the past few months.

FRANK K. SHAW has been appointed permanent secretary of the Industrial Bureau of the Atlanta Chamber of Commerce, succeeding Frederick T. Newell, who died several months ago. Mr. Shaw has been acting as temporary secretary. This bureau has charge of the $1,000,000 trade and class paper advertising campaign Atlanta is conducting through 1927, 1928 and 1929 to attract new industries to the Atlanta community.

WILLIAM J. SERRILL, assistant general manager of the United Gas Improvement Co., of Philadelphia, has been elected chairman of the American Engineering Standards Committee to succeed C. E. Skinner, chairman for the past three years. Mr. Serrill has been prominent in standardization activities in the gas industry for several years. Cloyd M. Chapman, engineering specialist of New York City, and representative of the American Society of Mechanical Engineers, will be vice-chairman of the committee.

GEORGE M. BINNS, of Halifax, Nova Scotia, who for the past 23 years has represented the Sheet Metal Products of Canada, Ltd., in the Maritimes, has been appointed Halifax sales manager of the General Steel Wares, Ltd., the combination formed by the union of the Thomas Davidson Manufacturing Co., Ltd., the McClary Manufacturing Co., the Sheet Metal Products Co., of Canada, Ltd., etc. The Halifax branch will look after the company's business in Nova Scotia, Prince Edward Island, and Newfoundland.

CHARLES L. JOBB has been elected president of Canada Iron Foundries, Ltd., succeeding the late Major Vincent J. Hughes. Mr. Jobb is also president and director of Paper Machinery, Ltd., and director, Port Hope Sanitary Manufacturing Co., Ltd. Some years ago Mr. Jobb was appointed general superintendent of Montreal Pipe Foundries, and when this company merged with the Canada Iron Corporation, he was appointed assistant manager of foundries, and this has developed into his present position as president of the Canada Iron Foundries.

Obituaries

HARRY H. ALEXANDER, service manager for the Indianapolis district of the Mack International Motor Truck Corporation, died recently in a local hospital. He had been in the city about three years, formerly having been connected with the same company in Chicago.

IRA H. SPENCER, president of the Spencer Turbine Co., Hartford, Conn., died April 28 at the age of 54. Mr. Spencer was an authority on central vacuum cleaners, air-compression engines and organ blowers. In 1892 he organized the Spencer Organ Power Co. and in 1907 the Spencer Turbine Cleaner Co., both concerns being consolidated in 1918 as the Spencer Turbine Co. He was a member of the American Society of Mechanical Engineers, an inventor of note with more than 100 patents pertaining to turbines and vacuum cleaning machines to his credit.

JOHN J. MARKEY, president and general manager of the Wrought Iron and Annealing Box Manufacturing Co., of Washington, Pa., died on May 2 after a protracted illness. He was 63 years old. A native of Wolverhampton, England, he came to the United States with his parents when 4 years old, grew up at Indianapolis, Ind., became a machinist and was employed for years by the Big Four and Chicago & Eastern Railroad companies. He organized the Indianapolis Forge Works, and in 1893 established the National Wrought Iron and Annealing Box Manufacturing Co., at Anderson, Ind. He transferred the company's plant to Washington twenty years ago.

Forthcoming Meetings

American Society of Mechanical Engineers. Spring Meeting, May 14-16, Pittsburgh, Pa. Calvin W. Rice, secretary, 39 West 39th St., New York City.

American Foundrymen' Association. Convention and Exhibit, Philadelphia, May 14 to 18. Technical Sessions at Hotel Belleview-Stratford; exhibit at Commercial Museum. R. E. Kennedy, secretary, 140 So. Dearborn St., Chicago.

Gray Iron Institute. Open meeting, May 18, Philadelphia Commercial Museum. D. M. Avey, temporary secretary, 1213 W. Third St., Cleveland, Ohio.

Southern Supply & Machinery Dealers' Association. Will meet in annual convention in Nashville, Tenn., May 15, 16 and 17 jointly with the **National Supply & Distributors' Association** and the **American Supply & Machinery Manufacturers' Association.**

Associated Machine Tool Dealers. Annual spring meeting, May 23 to 26, at Granville, Ohio. E. P. Essley, secretary, 551 W. Washington Blvd., Chicago.

National Association of Foremen. Fifth annual convention, May 25 and 26, at Canton, Ohio. E. H. Tingley, secretary, 1249 Unity Bank Building, Dayton, Ohio.

National Association of Purchasing Agents. Annual meeting and "Informashow," Kansas City, Mo., May 28 to 31. W. L. Chandler, secretary, 11 Park Place, New York.

American Railway Association. Schedule of sectional meetings: Division V, mechanical, June 20 to 27, Atlantic City, N. J.; Division VI, Purchases and Stores, June 20 to 22, Atlantic City, N. J.; Division VII, Electrical, Sept. 22 to 28, Cleveland, Ohio. J. W. Welsh, secretary, 292 Madison Avenue, New York City.

Association of Iron and Steel Electrical Engineers. Annual meeting, Stevens Hotel, Chicago, June 25 to 29. J. F. Kelly, managing director, Empire Bldg., Pittsburgh, Pa.

American Society for Testing Materials. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

Society of Automotive Engineers. 1928 Summer Meeting, Chateau Frontenac, Quebec, Canada, June 26 to 29. C. E. Heywood, in charge of meetings, 29 West 39th St., New York.

Canada's Steel and Power Show. Second annual show to be held at the University of Toronto Arena, Sept. 4-7. Secretary, Campbell Bradshaw, 24 Front St., Toronto, Ontario.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

National Safety Council. Seventeenth annual safety congress will be held in New York, October 1-5. Idabelle Stevenson, executive secretary, 1 Park Ave., New York.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Gear Manufacturers Association. Semi-annual meeting, Statler Hotel, Buffalo, N. Y., Oct. 11-13. T. W. Owen, secretary, 3606 Euclid Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

STEADILY increasing demand is noted in seamless steel tubing, structural shapes, railway car material, cast-iron pipe and reinforcing steel. Scrap prices remain firm in iron, steel and nonferrous descriptions. Black steel sheets rose 10c. per 100 lb. at Pittsburgh mill during the week; blue-annealed and galvanized are off 10c. and 5c., respectively. Demand appears slower in automotive and agricultural implement material. Employers' association representing about two-thirds of factories and shops in Detroit, reports employment of machine shop workers about 25,000 above that of a year ago and increasing at the rate of approximately 2,500 a week. Unemployment still exists, however, but without perceptible effect on wage rates.

(All prices as of May 4, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.50	3.25	3.90*
No. 12	2.05@2.15	3.55	3.30	3.95*
No. 14	2.15@2.20	3.60	3.35	4.00*
No. 16	2.25@2.30	3.70	3.45	4.10*
Black				
Nos. 18 to 20	2.70@2.80	3.75	3.55	4.00
No. 22	2.85@2.95	3.90	3.70	4.15
No. 24	2.90@3.00	3.95	3.75	4.20
No. 26	3.00@3.10	4.05	3.85	4.30
No. 28	3.15@3.25	4.20	4.00	4.45
Galvanized				
No. 10	2.90@3.05	4.10	3.90	4.25
Nos. 12 to 14	3.00@3.15	4.20	4.00	4.35
No. 16	3.10@3.25	4.30	4.10	4.45
No. 18	3.25@3.40	4.45	4.25	4.60
No. 20	3.40@3.55	4.60	4.45	4.75
No. 22	3.45@3.60	4.65	4.50	4.80
No. 24	3.60@3.75	4.80	4.60	4.95
No. 26	3.85@4.00	5.05	4.85	5.20
No. 28	4.10@4.25	5.30	5.10	5.45

*250 to 3,999 lb.; 249 lb. and under plus extra of 50c. per net order.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

WROUGHT STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	B.w.g. and Fractions	Outside Diameter in Inches—⅛	¼	⅜	½	⅝	¾	1	1¼	1½
		Price per Foot								
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23		
.049″	18	.17	.18	.19	.20	.21	.23	.25		
.065″	16	.19	.20	.21	.22	.23	.25	.27		
.083″	14	.20	.22	.23	.24	.25	.27	.29		
.095″	13	.21	.23	.25	.26	.27	.29	.31		
.109″	12	.22	.24	.26	.27	.28	.30	.32		
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33		
.134″	10	.24	.26	.28	.29	.30	.32	.34		

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			15.00
Tin, straits, pigs, New York			54.00
Lead, pigs, E. St. Louis	6.00	New York	7.00
Zinc, slabs, E. St. Louis	5.87½	New York	6.75

	New York	Cleveland	Chicago
Antimony, slabs	12.50	13.25	14.25
Copper sheets, base	23.00	23.00	22.75
Copper wire, base	19.50	19.62½	16½ (mill)
Copper bars, base	21.50	21.50	22.25
Copper tubing, base	24.50	24.50	24.50
Brass sheets, high, base	18.75	18.75	18.75
Brass tubing, high, base	23.62½	23.62½	23.62½
Brass rods, high, base	16.50	16.50	16.50
Brass wire, high, base	19.25	19.50	19.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	22½@24	24.30
Zinc sheets (casks)	10.00	10.75	10.36
Solder (strictly)	33.25	32.50	33@37
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			70.00
Commercial genuine, intermediate grade			63.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.00
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00	Electrolytic 37.00	Shot	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	28.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	12.37½@12.62½	11.50	11.25@11.75
Copper, heavy, and wire	11.50 @12.37½	10.75	10.75@11.25
Copper, light, and bottoms	10.25 @10.75	9.50	9.50@10.00
Heavy lead	5.00 @ 5.25	5.25	4.25@ 4.75
Tea lead	3.75 @ 4.00	3.75	3.25@ 3.75
Brass, heavy, yellow	7.12½@ 7.37½	7.25	7.00@ 7.50
Brass, heavy, red	9.25 @ 9.75	9.75	9.00@ 9.25
Brass, light	5.50 @ 6.00	5.75	6.00@ 6.50
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc	3.25 @ 3.50	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.13½*
Cotton waste, colored, per lb.	.09@ .13	.12	.10@.11
Wiping cloths, washed white, per lb	.15@.17½	38.00 per M	.17
Sal soda, per lb.	.02	.02	.02¾
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.76½	.84	.78
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.			
First grade	45%	50–10%	50%*
Second grade	50%	60–5%	50–10%†

*Special white; all waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0324	$0.0324
Cold drawn shafting	per lb.	.034	.034	.04
Brass rods	per lb.	.165	.165	.1587½
Solder (½ and ½)	per lb.	.335	.34	.4125
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.30	.30	.33
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.40	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
†Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.60@2.75		
Coke, prompt foundry, per net ton	Connellsville, 3.75@4.50		
White lead, dry or in oil	100 lb. kegs	New York, 13.75	
Red lead, dry	100 lb. kegs	New York, 13.75	
Red lead, in oil	100 lb. kegs	New York, 15.25	

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1¼ and 1½ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in dia.	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal—will receive bids until May 25, for screw cutting and turret lathes, power grinding machine, hacksaw, milling and drilling machines, electric welding machine, etc.

Ind., Anderson—Delco-Remy Corp.—machinery and equipment for the manufacture of electric windshield wipers for building No. 1, also equipment for the manufacture of wiring harness for automobiles for building No. 3.

Mass., South Boston (Boston P. O.)—Keystone Mfg. Co., 288 A. St.—heavy back gear punch press, 60 to 70 ton capacity, 5 in. stroke also milling cutter grinder.

Mo., St. Louis—Charles Sueme Furniture Co., 2226 Dickson St.—one Howell chisel mortiser, one dovetailing machine and one jigg saw.

O., Bucyrus — Gledhill & Kime Lumber Co., Cresline, E. P. Leonard, Bucyrus, Mgr. woodworking equipment including two combination woodworking machines, two motor saws, one sticker, etc. for proposed new plant, here.

O., Columbus — Columbus Coffin Co., Buttles Ave. and Factory St., E. Y. Clark, Mgr.—woodworking equipment for coffin and box factory.

Pa., Erie—Zurn Mfg. Co.—2¼ ton electric hoists and one 2 ton electric crane.

Pa., Reading—Reading Sheet Metal Products Co. Inc.—power press brake.

Pa., Scranton — International Correspondence Schools, S. Baker, Dir.—catalogs of tools and devices used in maintenance and repair of trackwork such as tamping bars and picks, claw bars, track jacks, rail benders, track gages, track levels, etc.

Ont., Kitchener — Kitchener Ornamental Iron Co., Guelph St., A. Lau, Mgr., prices and catalogs on complete equipment for new foundry. Estimated cost $80,000.

Opportunities for Future Business

Calif., Los Angeles — Willys-Overland Automobile Co., is having preliminary plans prepared for a 1 story assembly plant on Randolph St. between Riverside and Garfield Aves. in the Laguna-Maywood Industrial tract. Estimated cost $1,500,000. Austin Co. of California, 777 East Washington St., Archt.

Conn., Bridgeport—Uppercu Cadillac Co., 532 Fairfield Ave., awarded contract for a 1 and 2 story, 100 x 250 ft. garage and sales and service station on Fairfield Ave. Estimated cost $150,000.

Conn., New Britain—Fafnir Bearing Co., Booth St., awarded contract for addition to plant including hardening room, etc. at Orange and Myrtle Sts. Estimated cost $40,000. Noted Apr. 5.

Conn., Stratford — Baird Machine Co., Stratford Ave., will soon receive bids for a 1 story, 100 x 150 ft. addition to machine shop. Estimated cost $80,000. Fletcher-Thompson Inc., 542 Fairfield Ave., Bridgeport, Archts.

Ill., Chicago — Bassick Mfg. Co., 2650 North Crawford Ave., manufacturers of alemite fittings for automobiles, awarded contract for a 3 story, 81 x 120 ft. factory at 2638 to 2660 Crawford Ave. Estimated cost $200,000.

La., New Orleans — Monteleone Investments, Inc., will soon award contract for a 3 story garage on Bienville St. Estimated cost $150,000. Wogan & Bernard, Title Guarantee Bldg., Archts.

Md., Baltimore — Bethlehem Steel Co., Bethlehem, Pa., will soon award contract for a 1 story, 163 x 600 ft. fabricating, pattern and machine shops on Key Highway, here. H. V. Bisbee, Key Highway, Supervising Archt.

Mass., Attleboro—G. A. Sweeney, 160 South Main St., awarded contract for a 1 story, 100 x 120 ft. repair and service garage on County St. Estimated cost $40,000. Noted Apr. 26.

Mass., Beverly—Winer Bros., 193 Rantoul St., awarded contract for a 1 story repair and service garage. Estimated cost $40,000. Noted Mar. 15.

Mass., Boston—Charles St. Garage Corp., L. K. Morse, Pres., is having revised plans prepared for a 3 story, 80 x 100 ft. addition to repair and service garage at 252 Cambridge St., Lockwood, Greene & Co., 24 Federal St., Engrs. Noted May 3.

Mass., Framingham—Owner, c/o Rosenblatt Bros., Mallaney Bldg., will build a 1 story, 100 x 135 ft. repair and service garage at Union Ave. and Mt. Wayte Rd. Estimated cost $60,000.

Mass., Marblehead (Boston P. O.) — Brown & Merrill, Pond St., are having sketches made for a 1 story garage and repair shop on Pond St. Estimated cost $50,000. Private plans.

Mass., South Boston (Boston P. O.)—Owner, c/o J. H. Raeder, 53 State St., Boston, Archt., will soon award contract for a 5 story addition to repair and service garage at Old Colony Ave. and C. and 7th Sts., here.

Mass., Wakefield—W. T. Curley, Jordan Ave., awarded contract for a 1 story, 65 x 75 ft. repair and service garage on Main St. Estimated cost $40,000.

Mich., Grand Rapids — Kinsey Motors, Inc., 105 Sheldon St. S. E., awarded contract for a 1 story, 109 x 165 ft. garage and sales and service station on Cherry St. Estimated cost $75,000. Noted Apr. 5.

Mich., Highland Park (Detroit P. O.) — Chrysler Motor Corp. awarded contract for a 1 story plant for nickel plating. Estimated cost $50,000.

Minnesota — State Commission of Administration & Finance, 1246 University Ave., St. Paul, awarded contract for five maintenance shop buildings, offices, etc. at Mankato, Marshall, Owatonna and Windom. Estimated cost $30,000 each. Noted Apr. 12.

Neb., Scottsbluff—A. F. Middaugh, will soon receive bids for a 1 story, 100 x 140 ft. repair and service garage. Estimated cost $40,000. E. L. Goldsmith & Co., Archts.

N. J., West New York — B. Gilardoni, 324 11th St., is having plans prepared for a 2 story, 100 x 102 ft. garage. Estimated cost $150,000. J. Weber, 132 26th St., Guttenberg, Archt.

N. Y., Brooklyn—M. Wilner, 1657 50th St., had plans prepared for the construction of a garage, etc. at 13th Ave. and 63rd St. Estimated cost $65,000. S. L. Malkind, 93 Court St., Archt.

N. Y., Corona—Chadurjian Bros., 103-10 Astoria Ave., East Elmhurst, had plans prepared for a 1 story, 44 x 60 ft. garage at Roosevelt Ave. and East Peartree Ave. Estimated cost $100,000. C. Vanone, c/o owner, Archt.

N. Y., New York — Four Hundred East 59th St. Inc., E. Franek, Pres., 80 Maiden Lane, had plans prepared for a 5 story, 68 x 100 ft. garage, etc. Estimated cost $200,000. Hugo E. Magnuson, 420 Lexington Ave., Archt.

N. C., Gastonia — Cocker Machine & Foundry Co., iron founders and machinery manufacturers, awarded contract for two additions to plant to increase the capacity.

N. D., Grand Forks — Great Northern Railway Co., Railroad Bldg., St. Paul, Minn., awarded contract for a 116 x 566 ft. addition to roundhouse and 90 x 250 ft. machine shop, here. Noted Apr. 19.

O., Cleveland—Acme Auto Radiator Co., J. J. Bares, Mgr., 7707 Carnegie Ave., awarded contract for a 1 story, 36 x 176 ft. factory at 7120 Euclid Ave. Estimated cost $60,000. Noted Apr. 12.

O., Cleveland — Bishop & Babcock Mfg. Co., F. N. Mizer, 4901 Hamilton Ave., awarded contract for a 1 story, 120 x 120 ft. factory at East 49th St. and Hamilton Ave. Estimated cost $60,000.

O., East Liverpool—Patterson Foundry & Machine Co., plans the construction of a 1 story, 100 x 300 ft. foundry on East End St. Estimated cost $50,000.

O., Minerva — American Electric Switch Corp., plans the construction of an addition to plant for switchboard, panelboard, knife switch and shipping departments.

O., Mt. Vernon — C. G. Cooper, manufacturers of stationery steam engines, awarded contract for a 1 story factory. Estimated cost $40,000.

Okla., Oklahoma City — Hickman-Smith Co., 12 West 6th St., awarded contract for a 3 story, 75 x 140 ft. auto body factory on Broadway. Estimated cost $150,000. H. Reynolds, Terminal Bldg., Archt.

Pa., Ambridge — American Bridge Co., Frick Bldg., Pittsburgh, will build a 1 story addition to beam plant, here. Estimated cost $1,000,000. Private plans.

Pa., Philadelphia — J. C. Kahn, Morris Bldg., plans the construction of a 2 story, 60 x 277 ft. factory at Westmoreland and Stokley Sts. E. A. Stopper, 10 South 18th St., Archt. Welsboch Street Light Co., 20th and Arch Sts., lessee.

Pa., Philadelphia — Philadelphia Rapid Transit Co., Broad and Locust Sts., awarded contract for a 1 story 80 x 400, bus repair shop at Third and Huntingdon Sts. Estimated cost $175,000. Noted Apr. 19.

Pa., Philadelphia—Two Hundred Nineteen West Chetten Corp., c/o A. B. Lacey, 1012 Walnut St., Archt., will soon award contract for a 2 story, 97 x 155 ft. sales and service station. Estimated cost $150,000.

S. C., Hamburg—The Southern Railway System, Charlotte, N. C., plans to rebuild railroad and machine shops here, recently destroyed by fire. G. L. Sitton, Ch. Engr. (Eastern Lines).

Tex., San Antonio—J. M. Nix & Associates, c/o Lanier Hotel, are receiving bids for a 15 story garage and repair shop at Navaroo and College Sts. Estimated cost $400,000. Private plans.

Tex., Waco — June Machinery Co., D. June, 208 South First St., manufacturer of machinery and equipment, plans the construction of a new foundry and machine shop. Estimated cost $25,000.

Vt., St. Johnsbury—C. H. Goss Co., 17 Central St., awarded contract for a 1 and 2 story, 85 x 105 ft. repair and service garage. Estimated cost $40,000. Noted Feb. 23.

Wis., Milwaukee—Badger Meter Co., 841 30th St., awarded contract for a 1 and 2 story, 60 x 120 ft. foundry and carpenter shop on Milwaukee Ave.

Wis., Wausau—Bluhm Cab Co., F. Bluhm Pres., 410 Washington St., awarded contract for a 2 story, 60 x 60 and 37 x 60 ft. garage. Noted Apr. 5.

Wis., Wauwatosa — R. H. Bierman, 123 Wisconsin St., Archt., is preparing plans for a 2 story, 75 x 125 ft. garage, etc. at Greenfield and West Main Sts. Owner's name withheld.

N. B., St. John—Brantford Roofing Co., Brantford, Ont., plans the construction of a plant for the production of asphalt roofing and shingles, here. Estimated cost $150,000.

Ont., Windsor—Chrysler Corp. of Canada, Ltd., J. D. Mansfield, Pres. and Gen. Mgr., awarded contract for a 3 story, 100 x 400 ft. addition to plant. Estimated cost $200,000.

Que., Montreal—Guy Street Garage Co. Ltd., plans the construction of a garage at 1428 Guy St. Estimated cost $70,000.